SCIENTIFIC AMERICAN

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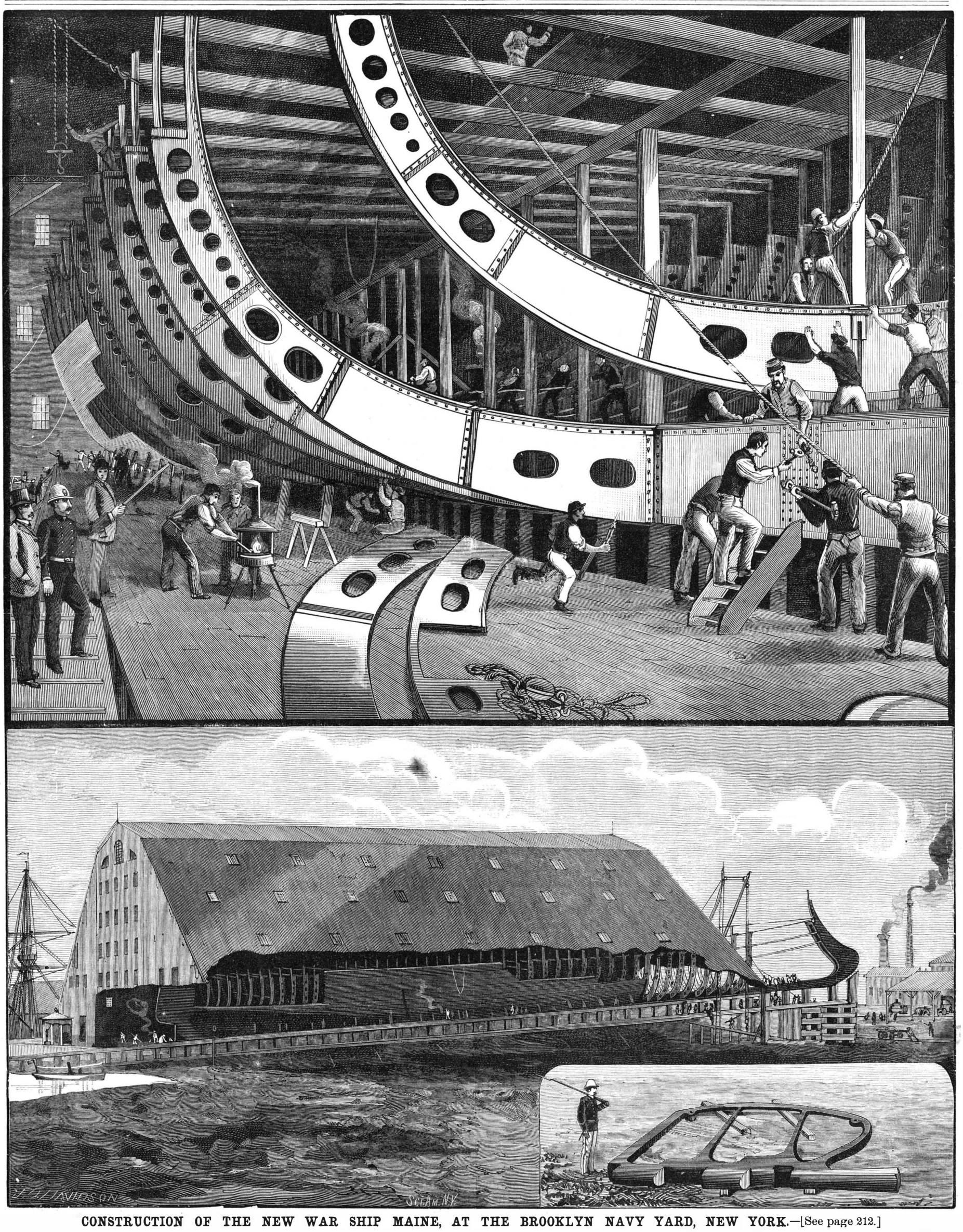

CONSTRUCTION OF THE NEW WAR SHIP MAINE, AT THE BROOKLYN NAVY YARD, NEW YORK.—[See page 212.]

Scientific American.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 713.

For the Week Ending October 5, 1889.

Price 10 cents. For sale by all newsdealers.

THE AMERICAN PUBLIC HEALTH ASSOCIATION.

The seventeenth annual meeting of this association is to be held in Brooklyn, N. Y., on October 22d to 25th of the present year. The objects of the association are the advancement of sanitary science and the promotion of organizations and measures for the practical application of public hygiene. At the forthcoming meeting, it has been decided to take a step in advance, and have an exhibition of everything available adapted to the promotion of health. The synopsis of this important and interesting feature includes nine divisions, subdivided into forty classes. The divisions embrace the dwelling, schools and education, clothing, food, sanitary engineering, public health administration, laboratory and "Red Cross" work. It is to be held in the hall on the corner of Fulton and Pineapple Streets, from October 22d to December 1st, and is to be open to the public. The subjects to be considered more particularly at the meeting embrace infant mortality, railway and steamship sanitation, cooking, contagious and epidemic disease, vaccination, and the sanitation of public buildings and institutions. The membership of the association consists of about eight hundred persons, including many prominent physicians and sanitarians. Its object cannot be too highly commended, and the idea of giving a practical interest to the occasion by an exhibition, with the consequent awards of diplomas and medals, is worthy of all praise. There is no reason to doubt that the exhibition will be taken advantage of by many inventors in this line of work, and that the first health exhibition in this vicinity will be the prelude to a long series of what our English neighbors would call "healtheries." America in many ways is in advance of other countries sanitarily. The extensive use of water has made elaborate sanitation a necessity, and much talent has been devoted to the subject here. We shall watch with interest the progress of the exhibition, knowing that American sanitarians and inventors give it the best basis for success.

A. N. Bell, M.D., of Brooklyn, is chairman of the committee on exhibits. J. H. Raymond, M.D., also of Brooklyn, is chairman of the executive committee.

THE PROFESSIONAL AND PRACTICAL ENGINEER.

The correspondence of such a journal as the SCIENTIFIC AMERICAN, one devoted to the scientific life of the world, includes many letters from aspirants to professional life asking for advice. One writer will wish to know what steps to take to learn electrical engineering; another will ask whether a college course is essential to a mechanical engineer; another, holding a position in a shop, will ask whether he should leave it and go to college. Many such queries are confidently referred to the editors of this paper for solution. With the most definite desire to assist such aspirants, specific advice can but rarely be given. The personal element enters so largely into the problem of life, that a confident answer cannot be based on letters alone.

Professional life is generally felt to be something outside of the business circle. Different qualities are supposed to be essential to one or the other vocation. The business man feels himself on a separate level from that of the scientist. The latter, on the other hand, is too apt to wrap himself up in an envelope of self-consciousness, and assume an intrinsic merit, due to his status, that shall supplant his personal defects. But if the real truth is sought, the matter becomes simplified. In nine cases out of ten, both the commercial man and the engineer will be found to possess practically the same qualities. Those attributes which carry success with them in one occupation will do the same in the other. Good strong common sense is the first element. Let this be joined with perseverance, and the same individual will attain his end either in one or the other branch.

It is often sad to hear men, naturally highly qualified, lament their want of education. It is doubly sad, because such want is generally due to themselves. Every one has some free time that can be devoted to study. But knowledge acquired in the regular routine at some scientific school seems to be regarded as the one and only "open sesame." Its want is made the excuse for what is little better than downright indolence. All over the land in the machine shops and engine rooms are men content to spend their lives in one dull routine, presumably because they were never highly educated. Yet every man could give from two to six hours a day to study. If properly directed, it would directly or indirectly help him on. If not so fully applicable to the struggle of a breadwinner as to entitle him to a higher position, it will at any rate inspire him with the ambition that will force him out of the routine of an unchanging occupation.

The history of this country gives excellent examples of the truth of what is here stated. It is full of instances of men who have attained fame and distinction from pursuing their studies alone and unaided. The self-made and self-educated have done more for America than have all the graduates of her colleges.

A young man who enters a technical school has before him three or four years of study of a very severe kind. Before entering he must be pretty well versed in mathematics and literature. If he studies properly and passes his examinations honestly, he will have to work hard. At the end of the term he graduates. The expectations which have been formulated during the terms of study will at first vary for each case. But unless he has influence, the prospects of each graduate will appear identical after a month. With all his education, the engineering world will offer no place for him. As week after week passes, his eagerness to be at work will grow until he is ready to begin a second education by working at anything approaching engineering, for any remuneration or for none at all. Now imagine some young workman fretting about his want of education. In a fit of supposed inspiration he resigns his position to begin a course of study at some school or college. The graduate whom we have pictured above would feel his fortune made if he could step into the discontented workman's place. It is the old story; every one is discontented with his own work, and envies that of others.

The above may read like a disparagement of the benefits of education, but it is not. An educated man will learn more in a shop in a month than an uneducated apprentice will in a year. But education alone, or even the happy combination of education and experience, are not enough to insure success. The well known figures of the percentage of business failures may be cited. Of one hundred business enterprises that are started, it is said that only three succeed. A professional career may safely be considered a business enterprise into which some money and much time has been put as the capital. Very few succeed. The reasons for failure are the same for the professional man as for the merchant. The indefinable quality, usually termed executive ability, is as necessary in one case as in the other. A man who will lead in business, if his attention had been directed to other lines, would have achieved a success in professional life. Energy, perseverance, the art of dropping completely anything that does not conduce to the end in view, the placing of temporal success as the *summum bonum* of at least one's daily exertions, these are needed as much for financial success in professions as in the merchant's office.

So many young men are now graduating from our technical schools, and the ranks are being so largely recruited from Europe, that college acquirements are rated rather low. After graduation, a term of years of poor remuneration lies before the aspirant for a place in the scientific world. After the struggle seems partly over, some reverse may occur that will put him back to the starting point. Professions have as distinct and as many failures as have business ventures. After a failure or loss of position comes the weary struggle to get back "into the swim." A human life has not time for many such cycles.

Such considerations are not pessimistic, but are the reverse. Instead of looking for a change to be reached by abandoning one's position and going to college, keep the position and make the change in yourself. Study at home in the evenings. Realize the fact that a year of study is nothing, that four or five years will be needed before it will tell. After a year the problem of the applicability of scientific knowledge to your life will be solved, as well as the practicability of obtaining it yourself. If it is in you to work up the ladder, you will find that in nine cases out of ten it is yourself who can supply the essential study and work. After four years, if what is here suggested is honestly and truly done, we believe that in most cases far more advance will have been made than if, abandoning shop work and its rough schooling, a young man enters college, to leave it quite possibly with seeds of fruitless discontent sown in his nature that will last him for life. Every man is his own school teacher, and makes his own education. If he does not succeed without a four years' course in a technical institute, it is his own fault. He must not blame circumstances for a personal failure.

THE NICKEL AND COPPER MINES AT SUDBURY, ONTARIO.

One of the attractions of the recent meeting of the American Association for the Advancement of Science at Toronto was the excursion immediately after the meeting to the region of Huronian rocks north of the Georgian Bay, under the direction of Drs. Selwyn and Bell, of the Canadian Geological Survey; and one of the most interesting features of the excursion was some hours spent at the Stobie and Copper Cliff mines, which are worked by the Canadian Copper Co., and at the Murray mine, which belongs to an English company. These mines are near Sudbury, which is about 300 miles west of Ottawa on the main line of the Canadian Pacific Railway.

The mines of this region are all new. Indeed, it was the building of the Canadian Pacific Railway only a few years ago that revealed the presence of nickel and copper ores in paying quantities. The ore is massive pyrrhotite (magnetic iron pyrites), carrying from 2·5 to 6 per cent of nickel, and associated with considerable chalcopyrite (copper pyrites). Traces of platinum and other rare metals have been detected, while gold occurs in paying quantities at several localities on the

Algoma branch of the Canadian Pacific, southwest of Sudbury. The sulphides seem to impregnate somewhat lenticular beds of diorite. These beds have a high dip toward the northwest, and extend in a rather irregular line from Victoria on the North Channel, 65 miles from Sudbury, northwestward to an undetermined distance beyond Sudbury.

Through the courtesy of the Canadian Copper Co. special engines were placed at the command of the geologists, and with Dr. Peters, the able superintendent of the mines, as a guide, the Stobie mine was visited first. This mine is worked as an open quarry, with shallow adits into the side of the hill. The ore is low grade, running only 2·5 per cent of nickel and the same of copper, and is not smelted by itself, but is used as a flux for the ore from the Copper Cliff and another mine belonging to the same company, which carries considerable silica. The Stobie mine was opened three years ago, but not much work was done at it for a year.

The principal mine of the company is the Copper Cliff, located about four miles southwest of Sudbury on the Algoma branch. It was opened in 1886, and was first worked as a quarry in the face of a cliff; but now mining is confined to a shaft which pierces the bed at an angle of 45°, and has reached a depth of 500 ft. The ore is high grade, carrying 4 to 6 per cent of nickel and 6 to 9 per cent of copper, but the abundance of siliceous gangue necessitates the use of the Stobie ore, rich in iron, as a flux.

The most modern methods of reduction are employed. The ore is roasted in the open air in great heaps, each containing 1,000 tons of broken and crushed ore. These piles are ignited by means of wood, which burns for about 24 hours, raising the sulphides to the temperature of ignition, when the sulphur in them maintains the combustion for two months. From the roasting heap the material goes to the smelters, which are water-jacketed cupola furnaces with forced draught. There are two of these smelters at work, one of which has been in operation without break since early in January, while the other has but just been finished and started. Each has a capacity of 100 tons of ore in 24 hours.

The matte produced by these furnaces varies in richness from that which carries 15 per cent of nickel and 25 per cent of copper to that which contains more than 20 per cent of nickel and 30 per cent of copper. Matte below the minimum just given is put through the smelter again. Nothing more than this crude reduction is attempted at the mine. Most of the matte is shipped to England, though some of it finds its way into the hands of Joseph Wharton, the nickel king of the United States.

The company operating these mines owns about ten square miles of mining country, and will undoubtedly become one of the greatest mining companies in the world, though as yet it has opened but one mine, the Evans, besides those just described. The efficient chemist of this company, Mr. F. L. Sperry, was the fortunate discoverer of the interesting new mineral sperrylite, $PtAs_2$, in the screenings from the Vermilion gold mines, 22 miles west from Sudbury, on the Algoma branch. This new arsenide was described in full by Professors Wells and Penfield in the *American Journal of Science* for January, 1889.

The Murray mine lies a mile and a half northwest from Sudbury on the main line of the Canadian Pacific. Work at it was begun only last June, but it bids fair to become a very valuable property. The ore taken out is intermediate in richness between that from the Stobie and that from the Copper Cliff mines. An interesting fact in connection with this mine is that this is the locality at which a cutting by the railroad first revealed the fact that there was valuable ore in the region.

But one other company is operating in this vicinity; it is the Dominion Copper Co., which is doing preliminary work five miles north of Sudbury.

E. O. HOVEY.

DAMAGE BY WATER IN PERU.

The tremendous power of water, shown by the recent disasters in the United States and elsewhere, finds ample illustration also in this country. The Oroya railroad, famous as one of the most remarkable pieces of engineering in the world, has furnished frequent examples of this power.

From the sea level at Callao it climbs to an elevation of over twelve thousand feet at Chicla, a distance by the road itself of eighty-six miles.

Crossing as it does deep valleys and clinging to the sides of lofty mountains, it was in its conception a challenge to the forces of nature, and has frequently been called upon to withstand their wrath. The last rainy season caused more serious damage than ever before experienced.

Traffic above San Bartolome has been suspended for some months, and aside from complications with the government which have prevented any great outlay, the bridges cannot be restored for many months.

On March 21, in search of a suitable site for an observing station for Harvard College observatory, I rode on mule back past the Verrugas viaduct, said by the Peruvian press to be the finest in the world. However this may be, it certainly was a magnificent structure, spanning one of the deep "quebradas" so common among the foothills of the Western Andes. It was situated at an altitude of 5,836 feet above sea level and was 575 feet in length, and supported by three iron columns, the center one of which was 252 feet high. These columns rested on solid foundations of masonry, so constructed as to withstand any ordinary flood. Looking up to it from below, it seemed impregnable, so much so that a few days later at Matucana, on my way back from Chicla, when news came that the Verrugas viaduct had been washed away, no one would believe it.

The next day I passed the place again. As on my way up, there was only a trickling stream emptying itself into the Rimac a little way below, but in no other respect did the valley present the same appearance. For half a mile below the bridges were masses of debris, huge bowlders and pieces of iron brought down by the water.

The Verrugas valley, although narrow, extends back an immense distance into the foothills of the Andes, and receives the rainfall on vast slopes that rise to the height of 10,000 feet. At this time there was a tremendous fall of rain, or "cloud burst," and in a few minutes, in place of a petty stream, there was a broad, deep torrent bearing down the steep valley immense bowlders. Without doubt it was these masses of rock, thrown with such force against the central column, that accomplished the destruction of this bridge, made by the Baltimore Bridge Company at a cost of about 600,000 soles, or $420,000.

On June 15, in the company of Mr. R. B. Hubbell, superintendent of the railroad, I visited San Bartolome, where extensive repairs were going on. Near this village is a deep cut terminating in a narrow valley crossed by a small iron bridge. The bed of a stream usually dry had been carefully prepared for flood by enlarging it and paving the bottom near the railroad with heavy smooth stones, to facilitate the passage of stones and other materials brought down in time of flood. This stream crosses the railroad at right angles. An eye witness of the event, who was obliged to run for his life, says that the fall of water was so sudden that the descending mass presented a solid wave front twenty or more feet high. In five minutes the bridge was carried away and the natural outlet of the stream was blocked with stones and mud and the torrent turned through the deep cut along the track of the railroad.

In spite of this abrupt change of direction, within an hour the cut was filled for a distance of several hundred feet with a mass of stones and mud to a depth of from ten to twenty feet. Some of these stones weighed several tons, and could not be removed by derricks without blasting. One who has seen the steep sides of these rocky valleys full of great bowlders barely waiting some force to remove them, will not wonder where Nature found the material for working this ruin.

S. I. BAILEY.

Chosica, Peru, July 25, 1889.

Seizure of the French Telephones.

An incident recently took place in Paris which well illustrates the real nature of the so-called republican government of France. On that day, being on the eve of the elections, the government took possession of the telephone lines in the most arbitrary manner. It was done as follows:

At 10 o'clock twelve engineers or sub-engineers, designated by M. Cael, directing engineer of the district of Paris, each accompanied by a police commissary, presented themselves at the twelve Parisian telephonic offices. In each of these offices they were received by a manager or high official of the General Telephone Company, assisted by a sheriff's officer.

The government hoped, by proceeding on a Sunday to these various violations of domicile, to avoid the legal reports of the ministerial officers; but, thanks to an ordinance of the President of the Tribunal of Commerce, the sheriff's officers required were authorized to work Sunday. These officers limited themselves, however, to verifying the facts. They could not draw up their reports till the next day.

In presenting himself before the delegates of the telephone company, the police commissary read the ministerial warrant of August 30, consecrating the seizing, and ordering the taking possession of the premises belonging to the telephone company. After this reading the police commissary informed the representatives of the company that he had received orders to place the engineer of the Administration of Posts and Telegraphs in office, and to warn the office employes that it was this new functionary they had henceforth to obey. It was M. Clement who arrived at the Avenue de l'Opera agency.

"Do you give way before the ministerial warrant I have read to you?" asked M. Clement of M. Lair.

"Not at all," answered the chairman of directors of the telephone company. "We shall only yield to force."

M. Clement hereupon informed M. Lair that the ministerial warrant empowered him to use force. "In that case," said M. Lair. "I give way; but you will recognize in your report that I have only yielded to force. You will also tack on to this report the written protest which I hand you in the name of the company."

A very amusing incident marked the seizure of the telephone office in the Avenue de l'Opera. The artist of an illustrated journal was sketching the scene in the office, when M. Clement went up to him, took his paper from him, and forbade him to sketch the scene. The seizure of the departmental offices was gone through with the same formalities and the same protests.

The "Hoop Snake"—the Black Snake not Poisonous.

The SCIENTIFIC AMERICAN has been requested to answer the following questions: "Is there such a thing as a 'hoop snake,' and has anybody ever seen one, or a specimen of one?" The way the "hoop snake" is said to move about is thus: It takes its tail in its mouth, coils itself in an ellipse, and moves around like a hoop. "If there is such a thing, where can I see a specimen, or in what work is it described?"

There are many persons who uphold the existence of the "hoop snake," yet all reports and declarations that have been advanced in its favor have all proved to be totally unreliable. The anatomy of a snake alone is sufficient to prove that hoop-like progression is impossible. The hoop snake has never been described by any naturalist in any standard work on reptiles, and no museum nor collection in the world contains a specimen of it. It exists only in the minds of the ignorant and unscientific, and it must be classed with ghosts, mermaids, winged snakes, sea serpents, and fishhook-tailed fishing snakes.

The second question is: "Is the bite of the black snake poisonous?" The common black snake of the United States, *Bascanium constrictor*, is not armed with poison fangs and glands, and consequently is non-venomous. Its specific name, *constrictor*, is a misnomer. Linne, its first describer, who never saw a living specimen, was wrongly informed that it crushed its prey in its folds like the boas.

The black snake of Australia, *Pseudechis porphyriacus*, is a venomous species much dreaded by man.

C. FEW SEISS.

Natural Gas in Wheeling.

The natural gas supply is becoming scarcer every day in Wheeling, and there is especial complaint among the manufacturers, who had hoped that during warm weather they would have all the gas they needed. For several weeks past the Riverside Tube Works and Plate Mill have been very greatly bothered by lack of gas, and at times during the day have been compelled to lay off until the flow became better. This was especially the case recently, and the company is now getting things in shape as rapidly as possible to go back to the use of coal in the tube works. The Bellaire Mill has gone back to the use of coal, and is using it in all departments. The Labelle is also receiving a very inadequate supply of gas, and it is understood they contemplate a return to coal in all departments. Several of the other mills and other manufactories are in the same position. The manufacturers have at last come to the conclusion that something must be done to protect themselves, and in view of this state of affairs the prospects are that a thorough test will soon be made in this vicinity for gas.—*Register.*

Sad Fate of Mr. Donkin, the Mountain Photographer.

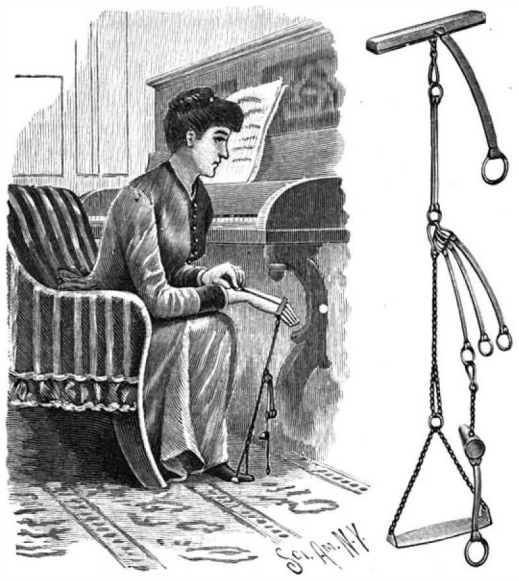
Those who are fond of seeing the magnificent photographic views of mountain heights which are now on exhibition in the picture shops do not realize the daring that is required to procure them. One of the boldest of these mountain photographers was Mr. Donkin. His views of the Alps are famous, and he set out a year ago to duplicate his achievements with the camera in the monarchs of the Caucasus. In ascending Mount Dychtan, however, the adventurous photographer fell a martyr to his enterprise. For a long time it was known that he had been killed, but the manner of his death was in doubt, and there were painful rumors current that he had been slain by the natives. But to ascertain the facts a party led by Mr. Dent, the president of the British Alpine Club, climbed Mount Dychtan to search for evidence. They found the photographic outfit of the unfortunate man at the brink of a precipice under such circumstances as to leave no doubt that he and his companions had slipped over the edge and been instantly killed.

Tangent Galvanometer.

In the tangent galvanometer described on page 181, current volume, the inner coil of no resistance is a copper band, the outer coils are of copper wire, of the following sizes and approximate lengths: Coil *b*, 150 feet of No. 18; coil *c*, 336 feet of No. 24; coil *d*, 373 feet of No. 30; coil *e*, 368 feet of No. 34.

A HAND EXERCISER FOR PIANISTS.

A simple device, so small and light that it can be conveniently carried in the pocket, and designed to afford ready means for exercising each and every muscle



BIDWELL'S POCKET HAND EXERCISER.

of the hand and wrist, to attain elasticity and rapidity of action as well as strength, is illustrated herewith, and has been patented by Mr. G. Hudson Bidwell, of No. 145 West Sixty-first Street, New York City. The device, as shown, is made with a light chain or cord, having a stirrup at one end and a snap hook at the other. For exercising the wrist and forearm, a heavy rubber band, with eyes or rings at the ends, is connected with the snap hook and with a bar adapted to be placed upon the back of the hand or the inner faces of the fingers, this bar to be held from displacement by a short band and ring to be grasped by the hand that is not being exercised. Bands of different degrees of elasticity are connected with the snap hook, for use as desired, and a finger cap is provided, which may be brought into engagement with any of the eyes or rings, to facilitate the exercising of the individual fingers. This device is designed to do away with much of the annoyance and tedium of piano practice.

AN IMPROVED ASH SIFTER.

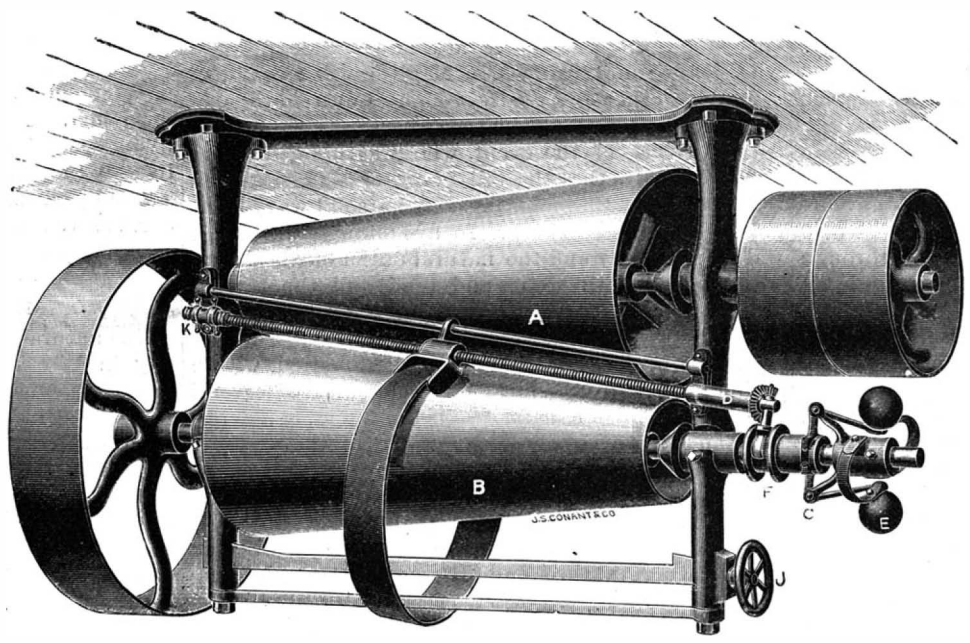
An ash sifter designed to be entirely dustless, and the labor of operating which is very light, is illustrated herewith, and has been patented by Mr. Joseph E. Crosby, of Westfield, N. J. The ash box proper has a hinged door at one end, secured by a hook and eye, and has an opening on top for about half the length of the box. At the side of this opening is hinged a sieve box, also having a hinged cover, the whole adapted to fold down and close the opening in the top of the ash box, as shown in the sectional view. The sieve is cylindrical in form, its bottom being closed by a disk centrally journaled on a stub or bolt in the lower end of the sieve box, and rods pass up on and are attached to two opposite sides of the sieve, to form projections extending slightly above its top or open end. A crank

CROSBY'S ASH SIFTER.

rod is centrally journaled in the hinged cover of the sieve box, a round cover to fit on the top of the sieve being fixed to the inner end of this rod, this cover having notches to engage the projections of the rods extending up the sides of the sieve, so that when the sifter is closed and the crank turned, a rotary motion will be given to the sieve. The ashes are brought to the sifter in a circular pan of the ordinary kind, to be placed bodily in the bottom of the sifter when in its open position. The ashes are not poured in, as in some other sifters. The hinged cover of the sieve box is then closed down and hooked in place, and the sieve box itself is closed down upon the ash box, leaving no openings for the escape of dust and ashes, when the rotating of the sieve by means of the crank turns the ashes down out of the ash pan and sifts them thoroughly, the ash pan normally remaining in position against the bottom of the sieve from the centrifugal force given by the turning of the crank. After the sifting is completed, and the dust has settled, the coal remaining falls back into the ash pan when the sieve box is again raised to a vertical position. The hinged door at the end of the ash box provides for the ready removal of the ashes when desired, or a suitable removable receptacle may be placed there to receive the ashes direct from the sieve and obviate the necessity of any rehandling.

THE EVANS SYSTEM OF FRICTIONAL GEARING.

A new departure in a well known subject of engineering practice is always of interest. We illustrate in the present issue an improvement in frictional gearing that may be properly termed such an innovation. It is the Evans frictional gearing. The simplest application may be seen in two cylindrical or straight-faced band wheels. If such wheels are pressed together, and if one is driven by power, it will cause the other to revolve, provided the frictional coefficient of the contact surfaces is high enough. In the Evans device this necessary element is introduced by the application of a short endless belt, which is placed so as to encircle one of the wheels, the driven one. It does not fit it tightly, but



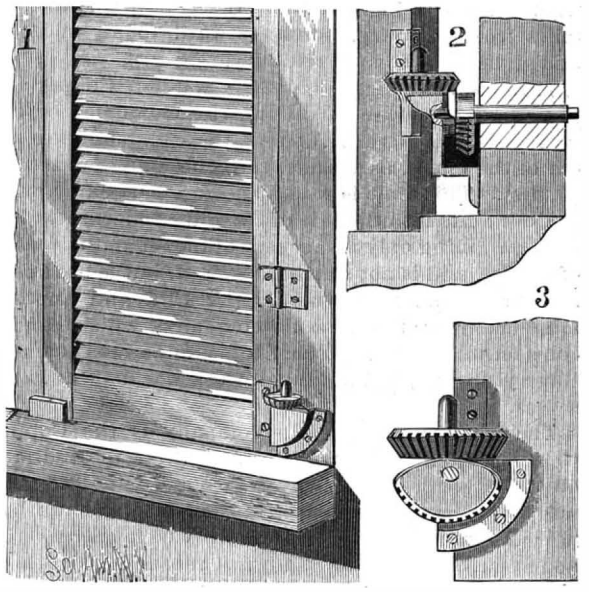
EVANS' FRICTIONAL GEARING AND GOVERNOR.

is considerably longer than the circumference of the wheel in question. If with the band in position the two wheels are pressed together, a very high coefficient of friction is established, and one that is independent of the tensional strength of the belt. The wheels can be made to grip with great power, and an Evans belt thus applied will cause an ordinary belt to slip.

On these lines a variety of applications have been made. In all of them a loose frictional belt is employed, and the shape of the pulleys driving and driven are arranged to conform with the work to be done. In the simple case of two straight-faced wheels any desired variation in size, so as to modify the velocity, may be given to the wheels respectively. Simple mechanism for pressing the pulleys together or releasing them is used when machinery is to be thrown into and out of motion.

Right-angle gearing, a substitute for miter-cut cog-wheels, is the next step. For this purpose the two wheels have coned faces, so that when in full contact their axles shall be at right angles to each other. A conical belt is used, which surrounds loosely one of them. To throw them in and out of gear, the shaft carrying one of them is moved either in the direction of its axis or at right angles thereto. The endwise motion of shaft is, for many reasons, the most advantageous, and has been adopted by the company.

One of its most important applications is to variable speed gearing. For such purpose two long truncated cones are used, arranged with their axes parallel. This brings the base of one opposite the truncated apex of the other. A narrow belt loosely encircles one of them. It is held in place by guides. When the cones are pressed together they are in gear, and the driving cone will actuate the other with a velocity dependent on the position of the belt. This may be shifted from end to end of the cones, giving a very wide range of speed, and may be actuated either by a hand shipper or automatically. In the cut the automatic system is shown. A centrifugal governor acts upon a long screw that moves the shipper in one or the other direction,



JORRES' SHUTTER OPERATING DEVICE.

[FOR DESCRIPTION SEE PAGE 213.]

so as to maintain a constant velocity. It is easy to see that a similar system could be used for automatically changing a constant speed of motion into a variable one, as where a gas engine has to drive a pump at varying speed.

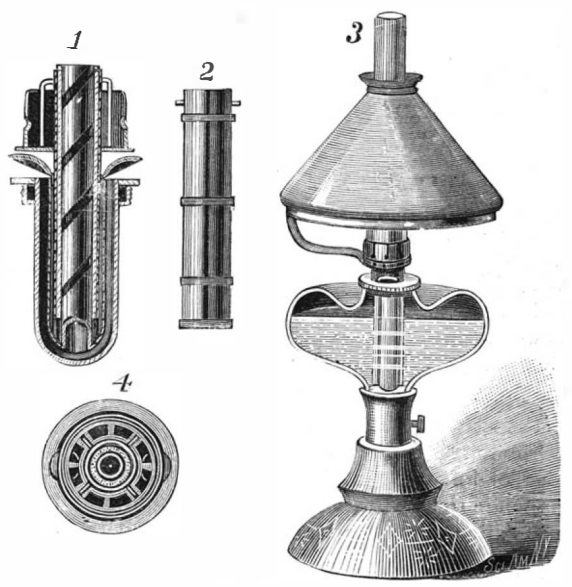
The application of this gearing to dynamo driving is of special interest. Owing to high speed and shortness of belts, much difficulty has been experienced in this class of work. Air cushioning, accompanied by slipping belts, has occasioned much trouble. In many cases space is of value, and short and inefficient belting has to be used. The Evans gearing enables the motor to be placed near the dynamo, thereby economizing space, and does away with the usual difficulties experienced with belting. It affords an instance of straight-faced pulley transmission, alluded to in the beginning of this article.

The power of the gearing has been shown experimentally by comparing it with that of an ordinary belt. Both were subjected to the same strain of tension for the belt and of compression for the gearing, and caused to work against each other. The belt was found to slip, while the frictional gearing held intact.

The address of the company is the Evans Frictional Cone Co., 85 Water Street, Boston, Mass.

AN IMPROVED LAMP.

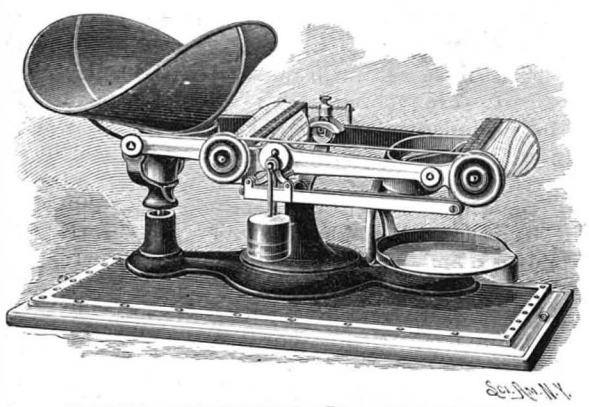
The accompanying illustration represents an improved lamp recently patented by Mr. Joseph E. Bissell, of Bartold, Mo., Fig. 1 showing a central sectional elevation of the lamp burner, Fig. 2 a side view of the longitudinally slotted wick-protecting cylinder, and Fig. 4 a plan view of the burner. The lamp is provided with an Argand burner, which has a cap plate with a threaded neck, the cap plate being formed with two apertures at opposite sides of this outer tube or shell,



BISSELL'S LAMP.

and the upper ends of a U-shaped air supply tube enter and are secured in these apertures. This tube embraces the lower part of the burner, and is apertured in the upper side of its bend, the lower open end of the

central air tube registering with the opening and being soldered or brazed thereto, so that air entering the upper ends of the U-shaped air supply tube will pass downward to its bend and upward through the central air tube to the flame. The lower end of the outer tube is also secured to the U-shaped air supply tube at the upper side of the bend to form two oil supply openings,

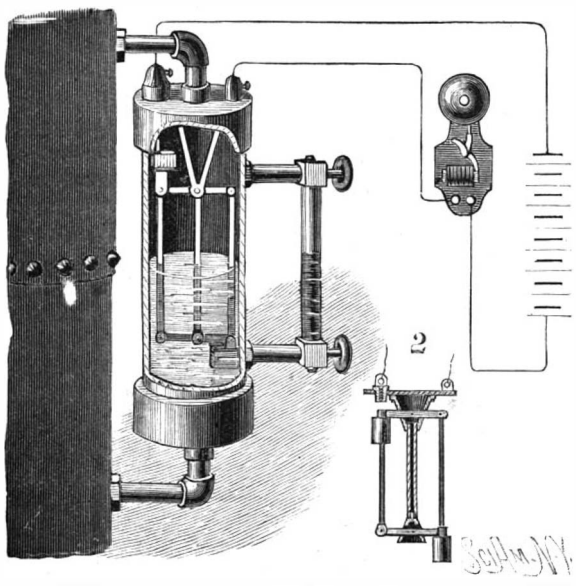


WANDS' PRICE INDICATOR FOR SCALES.

which allow the oil to flow freely to the wick, no transverse oil supply tubes leading into the outer tube being necessary. The upper ends of the U-shaped air supply tube are protected, and the draught steadied and regulated, by overhanging caps which project from a ring on the outer tube above the cap plate.

AN IMPROVED HIGH AND LOW WATER ALARM.

A device for attachment to steam boilers, water tanks, etc., to give an alarm when the water or other fluid falls below or rises above the prescribed limit, is illustrated herewith, and has been patented by Mr. Daniel H. Streeper, of Norristown, Pa. A suitable vessel is vertically connected with one side of the boiler above and below the water line, so that the water will stand at the same level in the vessel and in the boiler. To the inner side of the cap of this vessel is attached a downwardly extending arm, forked near its upper end, and to this arm two levers are centrally pivoted, one at the lower end of the arm and the other at the point where it is forked. To the ends of these levers, at one side, is pivoted a rod carrying at its upper end a float, and to the opposite ends of the levers is pivoted a rod carrying a float at its lower end. The rod carrying the upper float is prolonged upward through a short section of tube in the cap, and to the upper end



STREEPER'S ELECTRICAL HIGH AND LOW WATER ALARM.

of this tube is clamped a cap through which projects the contact point of a wire connected with one pole of a battery. A wire connected with the other pole of the battery is received in a binding post attached to another cap, extending also to the binding posts of the alarm bell. With the water at its normal level, as shown in the illustration, the floats balance each other, but on the rising or falling of the water to the position of either float, the levers pivoted on the central arm are tilted to raise the rod carrying the upper float, so that its upper prolongation reaches the contact point of the wire connected with the battery, thereby completing the electric circuit and giving notice by means of the bell that the level of the water is either too high or too low, a point which is determined by looking at the water gage. Fig. 2 shows a modification of the device, in which the tilting levers are fulcrumed in slotted cones connected by a section of gas pipe, the upper cone being attached to the top of the cap.

AN IMPROVED PRICE INDICATOR FOR SCALES.

An attachment for weighing scales, designed to indicate the value of any fraction of a given unit of weight, at any price per unit from one to one hundred, is illustrated herewith, and has been patented by Mr. Lucius L. Wands. Two cone-shaped indicators are used, divided into sections running at right angles to the axes of the cones, each section divided by lines parallel with the axis of the cone, and in connection therewith are arranged strips divided into sections corresponding with the cone sections, and numbered from two upward upon one strip, on which all the even numbers appear, the sections of the other strip being numbered with the odd numbers. In connection with the cones is a mechanism whereby they are each rotated by the movement of a balancing weight, the movements of the cones being in proportion to the distance traversed by the weight upon its supporting beam, while, to facilitate the reading of the cones, wires are provided which run in close proximity to the surfaces of the cones, and directly above and parallel with their axes. For further information relative to this price indicator address Mr. Hewitt Boice, Rondout, N. Y.

THE REMINGTON-LEE MILITARY MAGAZINE RIFLE.

This is the gun which has received the most pronounced recognition by the British government as their service arm to take the place of the single-loading Martini-Henry.

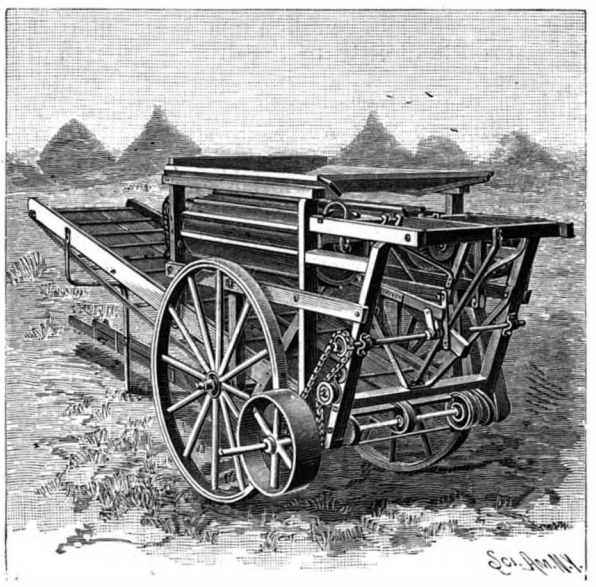
It has also quite recently been officially adopted by the United States Navy Department, and orders have been executed at the Remington Armory for a supply for the new cruisers, using Union metallic cartridges of caliber 0·45, 70 grs.

The success of this gun in the hands of the undisciplined Chinese troops during the Tonquin campaign of 1884 when pitted against the magazine rifles in the hands of the French, and with its other and more recent triumphs in competitive government trials, both in this country and in Europe, pretty clearly determine the superiority of this type of magazine guns. The caliber of the Lee rifles sold to the Chinese was 0·433, using the same cartridge as is used on the regular Remington rifle of Spanish model, which has been sold all over the world, and interchanging with the ammunition supplied with that famous weapon. The caliber adopted by the English government is 0·31. It is not surprising, therefore, that the other nations of Europe are adopting systems which, if not wholly of the Remington-Lee type as to breech mechanism, are in other particulars quite like it, France alone retaining the tubular magazine in connection with a smokeless powder for which they claim wonderful penetrative power. Hartley & Graham, Nos. 17 and 19 Maiden Lane, this city, are the manufacturers of the Remington-Lee magazine rifle, and will take pleasure in exhibiting the gun at their warerooms.

DURING the Conemaugh flood, thirty-two locomotives, some of them weighing 91,640 lb., were tossed about like corks, 23 of them being conveyed an average distance of 1,347 feet down stream, one going 4,844 feet, the shortest trip being 480 feet.

AN IMPROVED BAND CUTTER AND FEEDER.

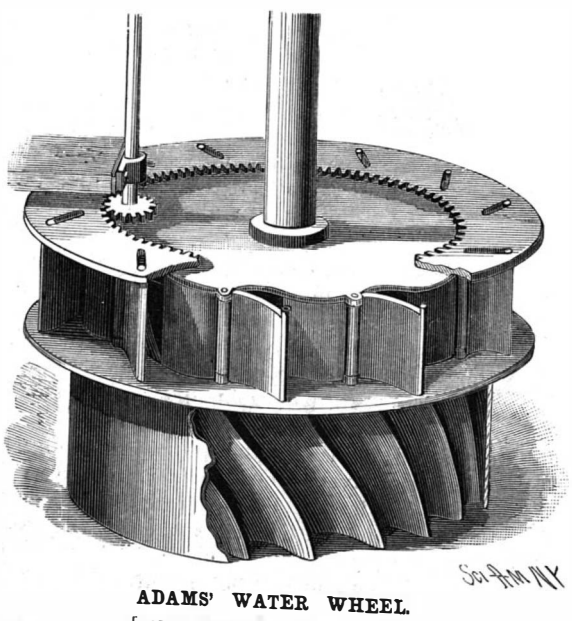
The accompanying illustration represents an attachment for thrashing machines for cutting the bands of the sheaves of grain and delivering the grain to the



COOK'S BAND CUTTER AND FEEDER FOR THRASHING MACHINES.

feeding drum of the thrashing machine. It is a patented invention of Mr. Henry C. Cook, of Mount Joy, Iowa. The main axle of this band cutter and feeder supports the side beams of an elevator over the table of which travels the usual endless belt, the outer end of the lower shaft carrying the pulleys operating the endless belt having secured thereto a pulley over which passes a belt driven from the thrashing machine with which the attachment is used. On the side beams of the elevator is a frame supporting a hopper with the usual central opening leading between two longitudinally fluted rollers, one of which rotates in fixed bearings and the other in transverse slots, where the ends of its shaft are pressed by springs, so that the roller will yield according to the size of the sheaf fed through the opening. On a transverse shaft mounted at the rear of the frame to turn in suitable bearings are formed four crank arms, in pairs standing diametrically opposite and at right angles to each other, two of these arms being adapted to operate knives mounted to swing directly under the rollers, to cut the band of the sheaf held between the rollers, while the two other crank arms give a swinging motion to shakers located alongside the knives and

THE REMINGTON-LEE MILITARY MAGAZINE RIFLE.



ADAMS' WATER WHEEL.

[FOR DESCRIPTION SEE PAGE 213.]

band is cut. Each of the shakers consists of a bar tapered at its inner end, where it is notched on top, and each of the knives consists of a steel plate pointed near its inner end and provided with knife edge teeth. Our engraving is made from a photograph of a machine now in use, and which is said to give good satisfaction, feeding the grain properly spread from the elevator belt directly to the drum of the thrashing machine.

BUILDING THE ARMORED CRUISER MAINE.

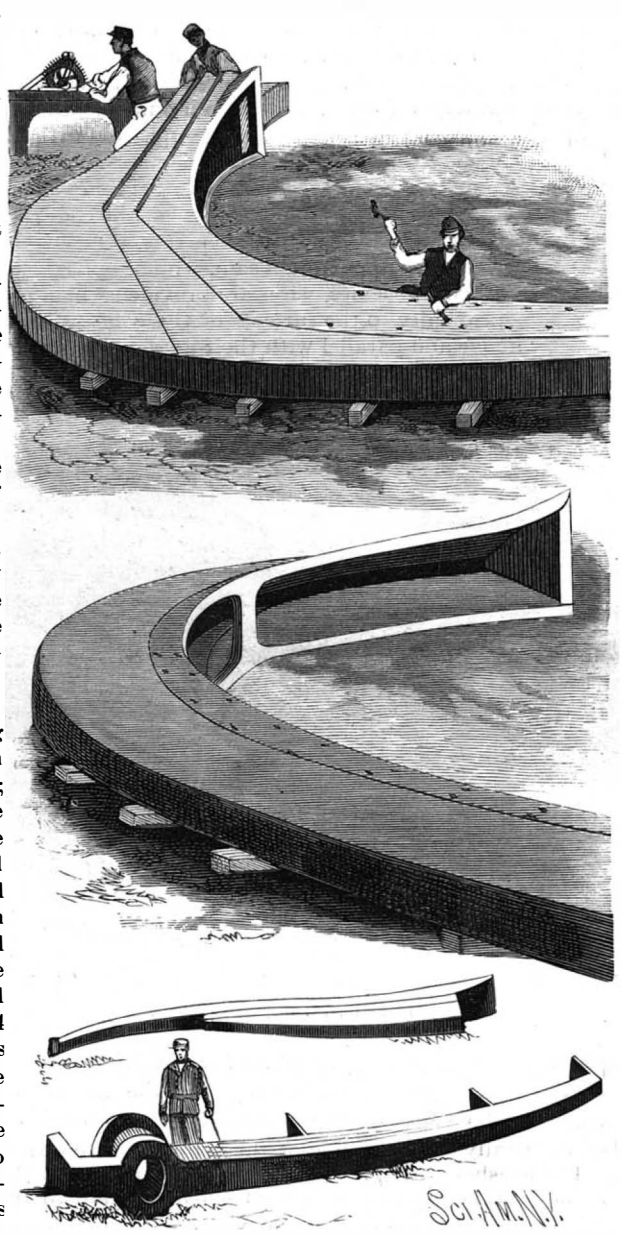
The building of a steel ship resembles in its first stages the building of a wooden one. First comes the keel, then the ribs. The frames are set up, the bends and curves following the desired lines with mathematical accuracy. Practically speaking, the result is a girder. The skeleton ship could be made to rest on its foot and heel, or poise upon its center, and the deviation from a straight line would be slight. The steel cruiser Maine, in course of construction at the Brooklyn Navy Yard, is now in the skeleton condition, most of the frames being up. When completed, she will be the largest vessel ever built for the United States Navy, being of 6,648 tons displacement. The mammoth shed where the work is in progress was erected during the civil war, and is situate at that point of the water line of the Brooklyn Navy Yard where a small flat-bottomed ferryboat plies back and forth along a rope connecting the cob dock with the mainland. Doubtless, to its constructors, the dimensions of this shed seemed sufficient for the longest craft that was likely to be built. Yet the prow of the Maine, with its steel ram and spur, extends many yards into the open. Inside this shed nearly three hundred men are now at work.

Steel ship building is now become a science, the constructors of the Maine working over charts and drawing boards, and poring over long lines of figures in the second story of a big granite building, instead of directing the shaping of the hull on the spot, as in the old days of wooden ship building. Then the shipwright moulded the bends and knees by rule of thumb, shaving this a little, or sawing and chopping that one to make it fit; a few inches this way or that was of no consequence. But now, every frame, every brace, every girder, indeed every plate, is fashioned in wooden strips in the moulding loft from figures furnished by the designer; the length and breadth, and even the curvature, of the part being closely looked to in the rolling shop or upon the cast iron slabs of another department, before it comes to the building shed.

About a year ago the keel plates of the Maine ar rived at the yard, and the work was begun of laying the keel. The plates are laid in an unbroken line from stem to stern, some of them being flat, some vertical; 40 feet deep in the midship section, and 35 where free from the second hull, the keel line being scarfed at the sternpost and the forefoot. After the keel was laid the transverse frames were raised—lowered would be a better term, as they are slung from cranes, each frame being in two parts, because of the weight and unwieldiness. There are eighty-four of these below the protective deck, made of angle bar 5 by 3 inches and weighing 10 pounds per foot, the reverse bars being 4 by 4 inches. They are braced by longitudinal frames extending also between the protective deck and the keel blocks, the weight and strength of these being increased forward and abaft the double bottom. The longitudinal frames run uninterruptedly from stem to stern, and have been designed and set with the purpose of supporting the shock of ramming as well as keeping the structure intact.

It was found necessary to erect a house in the yard in which to store the various parts of the Maine as they arrived from the steel works. This house is called the plate rack, and is 191 feet long by 31 wide. In it the plates for the hull are laid out or set up on end in regular order and numbered so that a master workman can tell at a glance where each belongs. The contract with the steel works in Pennsylvania where the work is being done calls simply for so many pieces of this or that size or shape. The contours, bends, curves, and rivet-holing are all done in the navy yard shops. The frames or plates, as they are needed, are first shaped so as to exactly correspond with patterns that have been made in the moulding loft. These patterns are made of thin strips of wood affixed together so as to follow the exact lines of each piece. A plate, for example, first goes to the roller shop, where it is smoothed out between two great iron rollers, being passed backward and forward and given its proper inclination, thence to the punching shop, where it is punched for riveting on the hull, also a work of great care, for unless the holes be exactly in place they will not correspond with their mates in the frames. At last comes the operation of countersinking, taking off the bulging edge about the holes and countersinking the orifices to receive the heads of the rivets. The frames are first taken to the furnace house and the forge, being then hurried upon the bending slabs, a great raised flooring of heavy steel plates perforated with holes. The wanted shape having already been laid out in chalk, the piece is bent this way and that by means of pries and levers in the hands of the workmen; one putting in a pin here to keep the curve secured, and others still pressing and tugging away to bend still more. Thus, when at last a piece arrives at the shed, the workmen have only to raise it and drive the rivets home through the corresponding holes in plate and frame, the foreman having shown them by reference to his drawings exactly how it is to fit.

A feature of the work on the Maine is the use of electricity as a driving and forcing power in putting the parts together on the structure itself; the first time, be it said, in the history of ship building, that it has thus been employed, and so far, for it has only recently been introduced, gives good promise. "The subdivision of power aboard a ship under construction, for use by the workmen at different parts of the framework, would," says Assistant Constructor Woodward, "be possible in several ways, either in sending it aboard the ship by a wire rope in transmission from a steam engine on the dock, the rope turning a system of shafting and belting, or by using hydraulic pipes to drive light and portable engines. The first is costly in time and labor to establish, the second is impracticable, because in the winter the water freezes in the pipes. As to electricity, the only trouble has been in finding a motor that will bear the rough use and exposure. After some experiment we found that several of the established electrical companies possess such motors. In the present method of utilization, the dynamos for generating are set up in the tool shop, being operated from the main line of shafting there long since established. A secondary battery of 50 cells is used as a regulator to allow for variation of speed in the main shafting. The current is conducted to the building ship by ordinary conductors and distributed so as to energize the various motors in use."



CASTINGS FOR RAM BOW AND STERNPOST OF THE MAINE.

The Maine has two bottoms or skins, braced stoutly one over the other, so that in case she strikes upon a rock and tears the under hull or skin, the only effect will be to admit the water between the two hulls and give her a lower set in the water for the loss of buoyancy, but remaining staunch and seaworthy. It may be said, in passing, however, that the precaution of double hulls would not save her if she were run upon a torpedo properly placed; though even then, unless the hull were badly shattered, the watertight compartments which divide her hull into isolated sections might serve to keep her afloat.

Each compartment of the double hull is complete, having a separate section, and may be flooded or emptied by means of powerful pumps and ejectors, these being connected as well with the various and separate compartments between the protective deck and the false bottom, the number of each being set in an indicator in the engine room and requiring but the pressure upon a valve to do their work. In the watertight compartments below the water line, and above the false bottom, are the magazine, shell room, and military stores room.

Not until after the Maine is launched will the great steel armor belt be fitted that is designed to protect her water line from hostile bolts. The reason for this is the great weight it will add, and consequently greater difficulty of launching. This belt will be made up of solid steel pieces, 13 inches thick, the first tier resting upon what is called the armor shelf, which will be seen by reference to the frontispiece immediately a-top the girders where the perforated beams end. These slabs of the armor belt will be backed by about four feet of solid oak and, at certain points, be still further supported by enormous coal bunkers.

The protective deck, which covers all, will have a maximum inclination of four feet, the plane of it being 3 inches, and the slope 4½.

Looking at the model of the Maine up in the designer's room, she is seen to be, when complete, a bark-rigged vessel, her bow sheering into a formidable ram just below the water line, the stern coming inboard instead of going outward at the quarter rail (see Fig. 2), with consequently no overhang and nothing above the water line to indicate that she possesses a sternpost or a rudder, for the latter are deeply submerged.

With brace and stretching piece, the flanges of the sternpost will be held, the same being used as supports for the end of the propeller shafts. Both stern and stem posts are of cast steel, rabbeted for the bottom plating to get a stout inset and powerful clamping; the under ends scarfed to the plates of the keel with canting-frame strengthenings to increase the backing of the ram. The rudder, a ponderous piece of steel, will be seen illustrated in the lower right-hand corner of the frontispiece, the sternpost and its lever in Fig. 3.

The engines and boilers are being made in a private works, and will be put aboard when the ship is launched. The engines will be of the vertical triple-expansion type, having eight boilers and three furnaces. The screws will have three blades, with a diameter of 15 feet each. There will be a coal capacity of about 800 tons, and, if the promise made for her should be realized, will be good for 17 knots under full headway, and at 10 knots headway be good for a voyage of 7,000 miles. Her battery will consist of four 10-inch breech-loading rifles, mounted two and two in echeloned turrets; six 6-inch breech-loading rifles; and a secondary battery of rapid-firing small guns, some below, some on the main deck, and a full battery of them atop each of the military masts.

Besides these, there will be seven torpedo-launching tubes or guns, four of these being on the berth deck, and three below the water line. There will be a bolt of 500 pounds weight fired from the 10-inch guns, the charge being 250 pounds of powder, the maximum range 9 miles. Both in the fore and after battery there will be a total weight of 2,200 pounds of solid metal that can be thrown at one discharge, and from either broadside about 100 pounds more than this. She will spread 7,135 square feet of canvas with everything clapped on, and carry a crew of about 350 officers and men.

Vine and Olive in Algeria.

In British Consul-General Playfair's report to the foreign office on the agriculture of Algeria, it is said that viticulture in that country is beset with many dangers. In spring, hailstorms frequently destroy the young shoots, the flowers are often ruined by fogs, and the ripe fruit by the sirocco. The most serious enemy is, of course, the *Phylloxera*, but the officials have been fairly successful in dealing with this pest. Another is the *altise*, a small beetle that causes great destruction, particularly when in its larval condition. The mode of killing the *altise* commonly adopted is to place bundles of grass and vine cuttings around the yard when winter is approaching; in these the insects conceal themselves in large compact masses, and the whole is then set on fire. Other diseases are the *oidium*, *anthrachnosis*, *peronospera*, and *chlorosis*. It is calculated that the want of intelligent treatment of these diseases causes the owners of the vineyards to lose annually nearly a third of the crop. The olive seems to grow everywhere in Algeria except in marshy ground, and attains dimensions quite unknown on the northern coast of the Mediterranean.

Prof. George H. Cook.

We have to announce with deep regret the news of the death of Prof. George H. Cook, State Geologist of New Jersey, and vice-president of Rutgers College. He died suddenly at his home in New Brunswick, on the afternoon of September 22, from failure of the heart, in the 72d year of his age. In a later issue of this paper, his life will be given at greater length. He was one of our most active scientific workers, and his death is a blow that will be widely felt.

AN IMPROVED WATER WHEEL.

A turbine water wheel designed to reduce friction and increase the effective attainable power is illustrated herewith, and has been patented by Mr. Henry J. Adams, of North Jay, Me. The buckets of the wheel extend in a reverse spiral line down its sides, and the wheel is inclosed in a casing made in two sections, a lower cylindrical section fitting loosely over the buckets, and a larger upper section having a sinuous peripheral wall, at the base of which is a flange, the top of the casing being closed and the bottom open. The inner bends of the sinuous peripheral wall of the top casing are on the line of the periphery of the lower section of the casing, and the outward bends form guides for the water to the wheel, openings or gateways being made at the inner bends and extending partly along the outer bends. Hinged to the sinuous peripheral wall within the top casing are gates, conforming in contour to its sinuous surface, so that when the gates are open, a curved surface will be presented to facilitate the passage of water to the wheel. The outer edges of these gates have lugs at the top, movable in inclined slots in a flat ring on the top of the casing, so that as the ring is rotated in one direction or the other the gates will be opened or closed, the ring having teeth on its inner edge meshing with the teeth of a pinion on a vertical shaft provided with a suitable handle or lever at its upper end. To obtain the full and best effect the buckets have a downwardly and backwardly trending and curved upper portion, starting from a vertical line at the top equaling in length about the height of the water inlets, and a lower portion, ending in a vertical line at the bottom, extending from the curved upper portion in a reverse spiral line, the concave face of the curved upper portion gradually widening at the edge or lip as it continues into the lower portion, while the buckets are concave on their face and have a convex back surface throughout their length.

Large Bending Rolls.

The large bending rolls that the Niles Tool Works are now building for the Mare Island Navy Yard, San Francisco, possess very interesting features. This machine will bend mild steel plates 2 in. thick by 22 ft. wide. It is guaranteed to bend armor plate 1½ in. thick by 22 ft. wide. The work is done by four forged rollers, two in the center, arranged one vertically over the other, to grip the sheet between them, and one on either side of the center to bend the sheet.

All the rollers are solid forgings. The center rollers are 32 in. in diameter and 22 ft. 6 in. long in the body, and weigh each 65,000 lb. The side rollers are 26 in. diameter, of the same length as the center rolls, and weigh 45,000 lb. each. The center rollers are geared together and driven by a pair of 12 by 16 in. reversible link engines. By these rollers the sheet is carried through. The side rollers, which bend the sheet to the required curvature, are not geared, but revolve by friction against the sheet. They are raised and lowered by heavy screws driven by a pair of 10 by 12 in. reversible link engines. All of the operations are controlled by levers conveniently placed for the operator. The weight of the machine complete will be about 220 tons. The rollers were forged and turned by the Cleveland City Forge and Iron Company.

AN IMPROVED SHUTTER WORKER.

A device by means of which window shutters may be opened or closed without raising the sash, and so arranged that when the shutter is opened it is held against accidental displacement, is illustrated herewith, and has been patented by Mr. Ralph W. Jorres, of Thomaston, Conn. Fig. 2 represents the device applied, with the shutter in open position, Fig. 3 being a sectional view, and Fig. 1 a view in perspective. To the window casing is secured a bracket having an upwardly extending pintle, and with a stop or limit plate, and a recess which serves as a bearing for the outer end of a shaft extending inward through the window casing, the inner end of the shaft having an operating handle. This shaft carries a segmental gear on one side, and on the other a flanged eccentric section, as shown in Fig. 3. To the corner of the shutter or blind is secured a horizontal disk carrying a segmental bevel gear, the disk being centrally apertured to receive the pintle on the bracket secured to the window casing. To hold the shutters in open or closed position, keepers are provided, formed with vertical flanges. With the parts as shown, when the operating handle of the shaft is turned to swing the shutter to closed position, the shutter is first raised vertically, carrying it clear of its outer keeper, and as the shutter is moved to a closed position the gears pass from engagement with each other, and the eccentric flange again bears on the under side of the disk secured to the shutter, permitting the latter to gravitate to its lower position within the line of the flange of the central keeper on the window sill.

ELECTRO-PLATING DYNAMO.*

The electro-plating dynamo differs from an electric lighting dynamo chiefly in its winding. For metallurgical work a large current of low voltage is required. For electrotyping, an electro-motive force of three to four volts is sufficient, while for nickel plating it should run up to about six volts, and for silver plating to about five.

In a small dynamo, like the one illustrated in Fig. 1, it is impossible to secure as wide a range of electro-motive force or of current as can be realized in a larger machine, but by varying the speed and by introducing more or less resistance in the external or internal circuit, the current can be adapted to most uses of the amateur. In the construction of this dynamo all of the dimensions of the cores and polar extremities of the field magnet and of the armature core, as given in the description of the hand power dynamo in SUPPLEMENT, 161, are followed except in regard to the thickness of the waists of the field magnets and their polar extremities. These dimensions are here increased by adding ⅛ inch to the thickness of the waists and ¼ inch to the thickness of the polar extremities, thus increasing the amount of iron in the field magnet.

The armature is wound with five layers of No. 12 cotton-covered magnet wire, and the terminals of the coil are connected with the halves of the commutator cylinder as shown in Fig. 2.

The commutator cylinder is formed of two sections cut from a copper tube and mounted upon a hub of vulcanite, or vulcanized fiber, the tube sections being separated from each other so as to form diagonal slits in diametrically opposite sides of the cylinder, as shown.

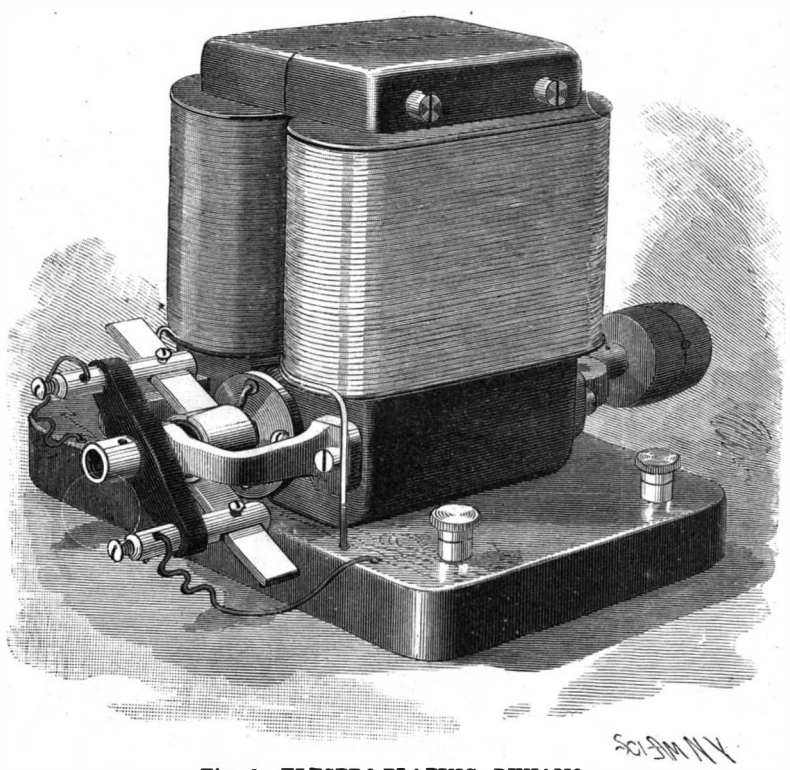


Fig. 1.—ELECTRO-PLATING DYNAMO.

The brushes are supported by mortised studs inserted in the ends of a cross bar of vulcanized fiber mounted on the journal box of the armature shaft. The threaded ends of the mortised studs project through the cross bar to receive binding posts which are screwed down tightly on the bar. In the mortises of the studs are placed the brushes, which press lightly upon the commutator cylinder. The brushes are formed of several thicknesses of thin hard-rolled copper.

The field magnet is wound with 12 layers of No. 18 magnet wire and is connected as a shunt to the armature. That is to say, the terminals of the field magnet wires are connected with the same binding posts that receive the wires from the commutator brushes, as shown in Fig. 3.

The conductors of the external circuit are also connected with these binding posts. When the connections are arranged in this way the current divides at the binding posts referred to, a part going through the wire of field magnet, another part going through the external circuit, which in the present case includes a plating solution.

To the negative conductor is attached the cathode or the plate or object which is to receive the deposit, and upon the positive conductor is suspended the anode or plate from which the metal for the deposit is supplied to the solution.

Unless the dynamo is at first started with a battery in circuit, it will be impossible to tell, without a test of some sort, which is the positive and which the negative binding post. This can be determined in a moment by trial in the plating solution.

If on starting the machine a deposit is made on the cathode, the connections are correct. If, however, no deposit appears, the conductors should be transposed either at the dynamo or at the plating bath.

Large wire should be used for carrying the current. Within certain limits the electro-motive force of the current may be varied by changing the speed of the machine, and the current may be controlled by inserting resistance into the external circuit or into the shunt.

The hand power dynamo referred to above may be converted into a shunt machine by arranging the connections according to Fig. 3, but it will be necessary to introduce resistance into the shunt or field magnet circuit to prevent too much current from going through the field magnet.

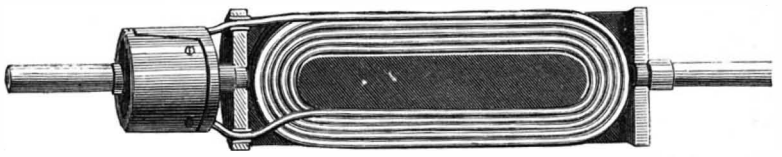


Fig. 2.—ARMATURE OF ELECTRO-PLATING DYNAMO—HALF SIZE.

The electro-plating dynamo may be used successfully in copper, nickel, and silver plating on a small scale, also for electrotyping.

The length of wire on the armature is 40 feet and on the field magnet about 500 feet.

*From "Experimental Science," by George M. Hopkins. Munn & Co., publishers, New York.

The Transandine Railway.

It is gratifying to note the progress which the Transandine Railway is making, due chiefly, says *Engineering*, to the energy with which Messrs. J. E. & M. Clark & Company are prosecuting the last and most difficult part of the work. The Andes are being crossed at the Uspallata or Cumbre Pass, where there will be a tunnel 3·1 miles in length, at an elevation of 10,450 ft. above sea level. The pass itself is nearly 3,000 ft. higher, or at 13,015 ft., and is situated 4¼ miles south of Aconcagua and 3·84 miles north of Tupungato, in 33° S. latitude. It will thus be seen that the summit level of the Transandine Railway is far above any European lines, which at the Rigi reach to 5,753 ft., and at the St. Gothard 3,788 ft.

The total distance from Buenos Ayres to Valparaiso is about 871 miles, and railway construction has now been going on for nearly twenty years. At the Atlantic end 640 miles of line are complete, while at the Pacific end 82 miles are laid, leaving 149 to be built. The gauge is uniform. From Buenos Ayres to Mendoza it is of 5 ft. 6 in., 426 miles being worked by the Buenos Ayres and Pacific Railway Company, and 213 miles by the Great Western Railway Company. From Valparaiso to Santa Rosa the gauge is 4 ft. 8½ in. The remaining link from Mendoza to Santa Rosa is now being built on meter gauge by the Buenos Ayres and Valparaiso Transandine Railway Company. The first 56 miles are nearly completed, the rails being laid for 40 miles.

According to the *Zeitung des Vereins Deutscher Eisenbahn-Verwaltungen*, an alteration of route has been made in the remaining part, and the ruling grade of about 1 in 25 has been abandoned. This change has been dictated by the adoption of the Abt system of combined adhesion and rack rail traction. The grades are

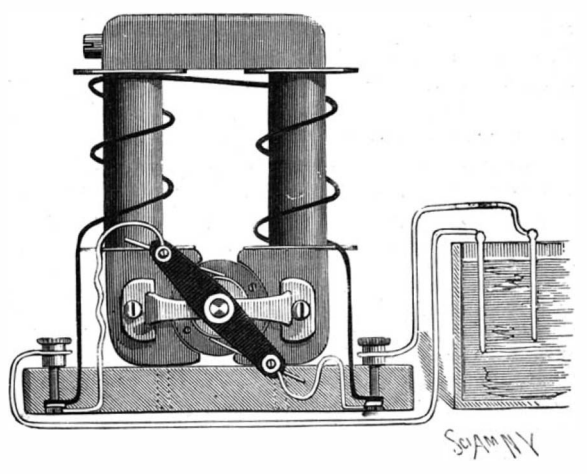


Fig. 3.—CONNECTIONS OF PLATING DYNAMO.

now to be 1 in 40 in the adhesion sections and 1 in 12½ upon the rack sections. The rack rail will consist of three rack bars, as at the Hartz Railway, and the order for it has already been placed with Messrs. Rinecker, Abt & Company, of Wurzburg. In the meantime, the Abt system has been adopted on the Ostrocas-Serajewo line, more especially for the passage of the Twan range.

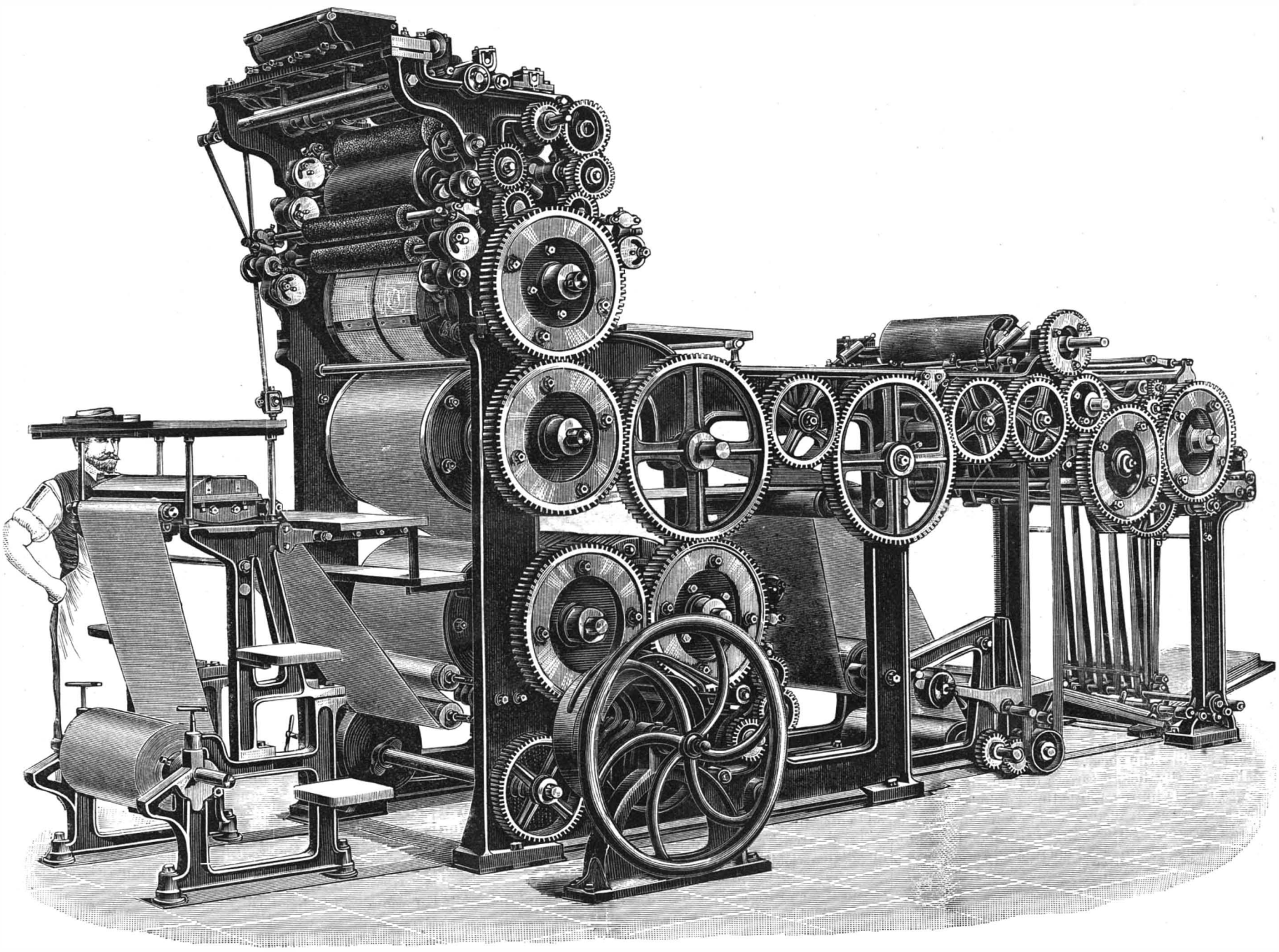
IMPROVED WEB PRINTING MACHINE.

The constant demand for printing machinery capable of producing good illustrated bookwork at a fast rate has induced several of the printing press makers to turn their minds to that description of machine. Our illustration represents a machine lately brought out by Messrs. Marinoni, of Paris, and built to the order of Messrs. Judd & Co., Limited, the Phœnix Printing Works, London.

Several important new features have been introduced into this machine. The paper, which is in reels, is fixed at one end of the machine, and as it unwinds between the reel and the first printing cylinder, it passes over a horizontal shield, which is heated by gas or steam. Under the influence of the heat the paper gets softer and will more readily take the ink. In fact, the heating of the paper replaces advantageously the old process of dampening. At the same time the ink dries rapidly and the "set-off" is very considerably reduced. However, to guard against this a continuous "set-off" sheet is run round the perfecting cylinder; and as it also comes from a continuous reel which unwinds itself as the machine is working, the other end is wound up again by friction between two grooved rollers, driven at such a speed that their circumferences travel at exactly the same rate as the printing cylinders.

Another feature in this machine is that tapes are entirely done away with, and the continuous web travels by itself to the cutting cylinders, from which grippers take the separated sheets to a vertical delivery flier with a right and left action. If the sheets are to be folded as soon as they leave the cutting cylinders, the grippers take them on to a folding cylinder which gives a perfectly accurate fold, and the subsequent folds are given in a special folder without tapes. The machine has been designed with a view to increased distribution of ink and full rolling power, and several devices have been adopted to regulate the inking, even when the machine is running.

All the working parts of the machine are perfectly accessible, and the paper as it goes through the machine is never lost sight of. This machine will print and fold a four-demy sheet on illustrated bookwork of the highest description at the rate of 5,000 perfect copies per hour.—*Engineering.*



IMPROVED CONTINUOUS WEB PRINTING MACHINE.

ABOUT 150 colors are now obtained from coal tar, which has almost entirely supplanted vegetable and

No Longer English, but American Capital.

Still the acquirement of large American plants goes merrily on, says *The Iron Trade Review.* Not to speak of the breweries and land companies and Western mortgages recently absorbed, the important news of the day is the proposition of an English syndicate (presumably the same one which purchased the Otis Iron and Steel Works, of Cleveland) to buy the extensive works of the Thomas Iron Company, at Hokendauqua, Pa. Proxies are now being taken among the stockholders for a vote, upon the question of sale, and it is announced that this, if effected, means a sort of iron and steel trust—though wherein the ownership of two concerns can be made to constitute a trust, does not at first appear.

These movements again press to the front the question, Is there any danger to our protective system in the absorption of American concerns by foreign capitalists? The New York *Press* has thought the question of sufficient moment to address letters of inquiry to leading Americans, and the replies, many and varied, are extremely interesting. While many see in the present movement a menace to American interests, unless carefully guarded by appropriate legislation, the general consensus of opinion, summed up in the two samples given below, seems to be that the more foreign capital we draw in, the better. With a broad, and as yet imperfectly developed, field for investment, with the increase of capital, and the consequent lowering of the interest rates, the results, it is argued, will be beneficial rather than harmful. As a member of the well-known firm of Marshall Field & Company, of Chicago, puts it: "These English investments have already brought over some of the best of British subjects to America. Where the treasure is, the heart is also. When they do come to live with us, the investments cease to be English and are positively American." Answering the objection that, while the investments remain here, the profits go out of the country, A. Shuman, head of one of the leading Boston houses, says: "Well, but isn't the country just so much richer and isn't the market expanded because of the stimulating influence of this outside capital? What if the profits do go abroad, doesn't the capital remain here? It has to, and we may well allow the exportation of $300,000 in the shape of profits on a working capital of $6,000,000. Doesn't that leave America ahead just $5,700,000 on this little financial transaction? . . . Let our friends on the other side bring over all the money they want; then, when it begins to look as if they meant to gouge us, let us legislate a little, and show them the power of a popular government by pinching their toes in the trap they set themselves."

Upon the same point, the Anniston (Ala.) *Hot Blast* says: "The probabilities are, of course, that the earnings of these properties will go abroad rather than remain at home. The probable consequence of such purchases is that they will lead to the coming here of a great many people who profit by such purchases. In itself, there is no particular harm to be anticipated from this tendency. It matters very little where the persons live who make the dividends, but of course it would be better to have them here to spend their moieties than abroad. Things like this regulate themselves. One thing about these Englishmen is that they pay big prices for what they buy and pay spot cash. They do not ask credit, don't jew us down, and treat us liberally and honorably."

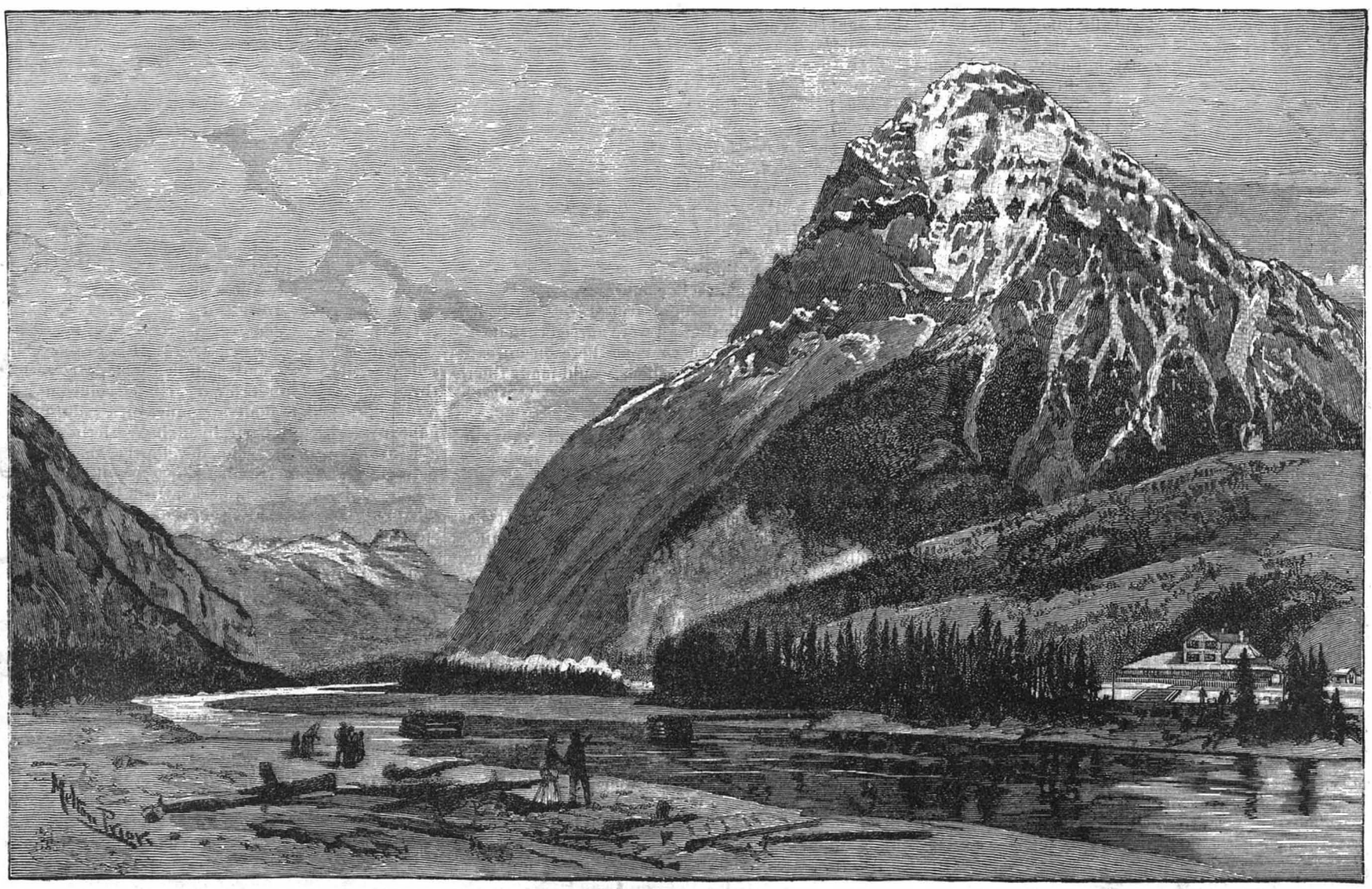
Yes, we can stand any amount of influx of foreign capital, but it should be distinctly understood from the start that, once invested in America, it becomes American capital, bound to respect American interests, and pay the American scale of wages.

Volcanic Eruption in Turkey.

A correspondent of the London *Daily Chronicle* states that particulars have reached Constantinople of a volcanic eruption which occurred some days ago in the province of Erzeroum, destroying the village of Kantzorik and the majority of its inhabitants. Kantzorik was a little village of 215 inhabitants, situated in the Caza of Tortoum, about 60 kilometers (37½ miles) north of the city of Erzeroum. The village nestled in a narrow fertile valley about 1,600 meters above the level of the sea, on the slope of the eastern mountains. Before the eruption the inhabitants were startled by subterranean noises, and they noticed at the same time that the springs on a mountain which stands at the eastern end of the valley were dried up. Alarmed at these phenomena, they appealed to the nearest local authorities, and were advised at once to evacuate the village. The warning for the majority was too late. Toward midday, while the terrified peasants were preparing for flight, the eruption came. The torrent rushed down, bearing on its molten surface bowlders and masses of earth torn from the surface or belched from the heart of the mountain. The whole village, with 136 persons, was engulfed in the stream.

MOUNT STEPHEN.

The Canadian Pacific Railway passes up the valley of the Bow River, from Banff, ascending the eastern slope of the Rocky Mountain range and entering the province of British Columbia, which is part of the Dominion of Canada. Passing the Summit Station, just a mile above the level of the sea, with three small green lakes in rocky recesses, it proceeds through the Kicking Horse Pass. Here the streams begin to flow westward to the Pacific Ocean. "Ten miles beyond the summit of the pass," says a descriptive writer, "we round the base of Mount Stephen, a stupendous mountain rising directly from the railway to a height of more than 8,000 feet, holding on one of its shoulders, almost over our heads, a glacier whose shining green ice, 500 feet thick, is slowly crawling over the edge of a sheer precipice of dizzy height, from which falling fragments of ice are dashed to atoms below. We look down from the railway, clinging to the mountain side, upon the river valley, which here suddenly widening holds between the dark pine-clad mountains a mirror-like sheet of water, reflecting each peak and cliff with the most startling effect." Some distance beyond is the wide, forest-covered valley of the Columbia River, with the mountains of the Selkirk Range.



CANADIAN PACIFIC RAILWAY—MOUNT STEPHEN, THE SUMMIT OF THE ROCKY MOUNTAINS, BRITISH COLUMBIA.

British Columbia (including Vancouver, Queen Charlotte, and other islands along the coast) is that portion of Canada which looks out on the Pacific Ocean. It is the only British territory on the western or Pacific Ocean side of the North American continent. There is abundant proof of the existence of great mineral wealth in British Columbia. Gold, coal, silver, iron, copper, galena, mercury, platinum, antimony, bismuth, molybdenum, plumbago, mica, and other minerals have been discovered in different parts of the province, copper being very widely distributed. The rich valley of the Lower Fraser, or New Westminster district, is the largest compact agricultural district. It is on the mainland shore, opposite the southeastern portion of Vancouver Island. The surface of the lower part of the valley is little above the sea level. This is the only large tract of choice agricultural land, on the mainland of the North Pacific slope, that lies actually upon the ocean, with a shipping port in its midst. A navigable river cuts it through, which is sheltered at its mouth. The Canadian Pacific Railway, as already said, runs through the district. The river is full of salmon and other food fish, and the district abounds with game. The delta lands and the clay loams can hardly be equaled for strength and richness, yielding great yields with comparatively careless cultivation. Much also of the interior is good farming land, and some highland districts afford very fine pasturage. The climate of British Columbia, in general, is much more temperate than the climate of any part of Canada lying east of the Rocky Mountains. Behring's Straits, between America and Asia, are so narrow and shallow that not much of the icy Arctic current flows along the British Columbia coast. The Rocky Mountains, in British Columbia, trending northwesterly, keep off the cold north winds. Other causes of the temperate climate are the existence of a warm ocean current in the Pacific Ocean, which flows toward the coast, the prevalent warm southwesterly winds from that ocean, which blow over the country, and also the north and south direction of the principal valleys, up which warm air from the south is drawn. The forests yield a vast supply of timber, and the fisheries are of great value. The population of British Columbia is now about eighty thousand, its capital is Victoria, in Vancouver Island.—*Illustrated London News.*

Prevention of Typhoid Fever.

The State Board of Health of Kentucky has issued the following circular, which is important to all sections of the country where typhoid fevers prevail, and especially at this season of the year should its counsels be regarded:

This board desires to call the attention of our health authorities and people to the gradually increasing prevalence of and mortality from typhoid fever, and to the growing importance of a constant resort to the methods which modern scientific researches have suggested for the prevention of this disease.

These preventive measures are of the more importance to the State because directed against a disease especially prevalent and fatal among persons in the prime of life, who contribute most to the public wealth and prosperity. Considered purely as an economic problem, the feature of it probably least thought of by most people, the importance of this disease can scarcely be overestimated. Statistics show that ten persons are sick for every one that dies of this disease, and to say nothing of the cash value to the State of those who die every year—and it is conceded that the State has no more valuable property than that represented in its vigorous population—the loss of time and labor, and the necessary cost incurred in attention to those who finally recover, makes an annual tax upon our people of startling proportions.

Typhoid fever is probably the most preventable of all diseases, not even excepting small-pox. It is now known that, like cholera and dysentery, the germ or specific cause of this disease is contained in the discharge from those sick of it, and that while other methods of introducing the poison into the system are possible, it most generally gains entrance through the medium of an infected water supply—usually the use of well water polluted by fecal matter. This may be direct from such water, or indirect, by using milk or other articles of food or drink from cans or vessels washed in it. Ice, from an infected source, is also dangerous, since it has been proved that freezing does not destroy the infective principle.

While water from all sources of supply is liable to contamination, well water is especially so, whether located in city, town, or summer watering place, or country. Thus out of 314 cases occurring in Louisville in 1884, 298 of the persons used well water habitually, and some of the other 16 did so occasionally. In the now famous epidemic at Plymouth, Pa., involving the sickness of 1,104 persons, the death of 114, and an actual outlay in money of $67,100.17, the outbreak was traced to the use of water polluted by the fecal discharge of one imported case of the disease. Facts no less convincing might be multiplied indefinitely if space permitted. In a smaller way they are common in the experience of physicians in active practice.

Usually the wells are sunk near the kitchen, and in dangerous proximity to the privy and other sources of contamination. The well draws its supply from an inverted cone, having its apex at the bottom of the well and its base at the surface of the ground. In dry seasons this base is often extended until the well becomes a receptacle for the more or less perfectly filtered filth from all the sources found in the average back yard, and the water, often sparkling in its apparent purity, becomes a culture fluid for any disease germs finding their way into it.

Two methods of prevention, having the same general object in view, are to be recommended. The first involves the thorough disinfection of all discharges from the bowels of typhoid fever patients. This is best done by the use of a solution of chloride of lime, 8 ounces to the gallon of water, using a quart of this solution for each discharge, and allowing it to stand in the vessel at least an hour before emptying. A solution of corrosive sublimate, 2 drachms to the gallon of water, will answer the same purpose, but requires to remain longer in contact with the material to be disinfected. Bed and body linen soiled by such patients should be disinfected by the use of the same solution or by boiling.

The second method relates to avoiding the use of suspicious water, and especially well water, and where this cannot be done, to boil such water before it is used for drinking purposes. In the absence of a pure and well-guarded public water supply, properly stored cistern water is probably open to least objection.

The effectual practice of these methods will require intelligent care and some expense, but it is confidently believed that their general adoption would result in the practical disappearance of a disease which is not only a disgrace to our civilization, but an annual scourge and tax upon the people of Kentucky, in comparison with which yellow fever and cholera sink into insignificance.

American Workmen Back from Europe.

The party of fifty American workmen who went to Europe in July under the auspices of the Scripps League, for the purpose of looking into the Old World way of manufacturing and finding out how European workmen live, got back to New York September 12.

On the question of the comparative productiveness of the American and foreign workman they were in a unit in support of the superiority of the former. This, they held, was partly because the American worked harder and for longer hours and with fewer holidays than the foreigner, but mostly because of the vast superiority of the American machinery.

A. T. Anderson, the tinsmith of the party, said, "I saw a remarkable exemplification of this fact in Liverpool, where I saw the leading tinsmithing establishment at work turning out a buoy. They were stamping out some half-spheres, and it took them nine processes to accomplish a result that is reached in our stamping works in three processes."

William Hanna, a Cleveland, Ohio, iron worker, said, "I am not exaggerating when I say that if I had in a mill in Cleveland the plant which I saw in operation in a mill in Glasgow, Scotland, I would break that plant up for scrap iron. We tried to get into Cammell's and Brown's works in Sheffield, but they would not let us in. The condition of workmen in my line abroad I found to be decidedly inferior to what it is in this country."

Mr. Cheney, the miller of the party, who is employed in the monster Washburn mill at Minneapolis, said, "At the Paris exposition the foreigners displayed with great pride their lay-out of milling machinery. It was very pretty and bright, but they did not seem to think so much of it when I told them that what they were exhibiting as the latest milling devices I had just taken out of our Minneapolis mill and replaced with improved machinery. Their machinery is too slow. We beat them in swiftness of work every time."

Mr. Ogden, who represented the American printers, said that he found the mechanical part of the printing business in Europe just where he had found it in this country when he learned his trade twenty-two years ago. "The quick men of their composing rooms," he said, "are not up to our slow men. Their stereotypers do quick work. Those who do the work for the 'favorite editions' of the London afternoon dailies, which often run up to 110,000 to 120,000 copies, are as quick as our stereotypers, but their work is not so good, and these papers have a ragged appearance that would not be tolerated here. The composing rooms lack comfort, are poorly lighted, and are unhealthy."

"The impress of the American inventor is nowhere more marked abroad than in their shoemaking machinery," said Hugh Cavanaugh, a shoemaker from Cincinnati. "There is a strong indisposition on the part of manufacturers to use improved machinery, and such machinery as they employ is based on American ideas. A workman there, however, is not expected to do more than from 65 to 75 per cent of what an American workman accomplishes. There seems to be no desire to test man and machine to their full capacity. It really costs more money there to make as good a shoe as is made here, but instead of thus producing better machinery in order to produce better shoes, the people are satisfied with the poorer product. With the exception of one or two factories in Paris, none of the foreign makers turns out a shoe that has any pretension to style. The workmen take life easily. They work fifty-four hours in the week and have lots of holidays. They are well organized and are looking forward to bringing down the hours of labor to eight per day. Rents are far cheaper there than here. The president of the Leicester (England) shoemakers' union lives in a comfortable six-room house for which he pays 6s.—about $1.50—a month. There are 30,000 shoemakers in Leicester, and the general run of them have snug quarters of from four to six rooms each."

Mrs. Barry, who is familiar with the condition of workingwomen in this country, who made a thorough investigation of how they fare abroad, said: "The condition of women who work in Europe is in many instances deplorable. There is much fault to be found in America, but with a single exception the workingwoman of a given kind in America is better off in every respect than her sister abroad. The exception I allude to is the woman engaged in clerical work. In England she works from 10 in the morning till 5 in the evening. In America she begins at 8 in the morning and ends at 5. But woman's pay in every branch of industry in this country is better than in Europe, and it will cost a woman in Europe far more money than it does an American woman to live in the same comfort that the latter does. In the "Black Country" of Devonshire, England, I saw women at the anvil making nails and chains, swinging the hammer with a vigor that would shame some men. In many iron foundries I found women performing men's work, and some of them so engaged were over sixty years of age and had been at it all their lives. The seamstress in this country is, bad as her condition is made by the imported shop system, better off than her sister abroad. Women there make shirts with hand needlework for 18 cents apiece, and with the machine for 30 cents per dozen. The women who make nails and chains at the anvil get 36 cents a day."

Joseph Thorpe, an engineer from Murfreesborough, Ill., said that he had talked to several of the oldest engineers in England, and found them all anxious to come to America, but all declaring that they could not save enough money from their small wages to bring them here. They had for years been trying to have the American locomotive cab for the engineer and driver introduced on English roads, but as a reply to their importunities their employers had taken away their wooden seats, urging as a reason that there is less chance for a man to go to sleep while standing than while sitting. They were, however, working hard to effect an organization of the engineers, firemen, guards (brakemen), signalmen, and switchmen, and hoped that their condition would be improved soon after it was accomplished.

William Delaney, a bricklayer, said: "I saw no work in my line on the other side which compares with the work done in America. Wages are lower there."

William T. Lewis, president of the miners' organization, said: "Wages are low abroad as compared with wages here, but the work is steadier. On the whole I think we are better off."

Edmund M. Vail, a blacksmith, thought that men of his craft in this country were doing better than those he saw in Europe. The blacksmiths abroad whom he found best off were those in Glasgow. Those in Germany, France, and Holland were far behind their English brethren.

All in the party were agreed that they had had a jolly time of it. They had been welcomed everywhere. In England they failed to run foul of the reported insular prejudice, and were entertained by members of Parliament, a live marquis, him of Ripon, and several other high dignitaries. Not one of the party had gone astray, but all were agreed that if fifty foreign workingmen were to come here on an expedition of study, very few of them would make the return trip.

Expedition to Observe the Eclipse of the Sun, December 22.

The last session of Congress appropriated $5,000 to defray the expenses of an expedition to be sent under direction of the Secretary of the Navy to the west coast of Africa, to observe the total eclipse of the sun on December 22. It is reported that the Pensacola will be employed for this expedition, and the preliminary details have been arranged by a board, of which Commodore John G. Walker, chief of the Bureau of Navigation; Capt. R. L. Phythian, superintendent of the Naval Observatory; Prof. Asaph Hall, of the Naval Observatory; and Prof. Simon Newcomb, superintendent of the Nautical Almanac, are members. One of the navy officers, familiar with the details, says: "The expedition will be divided into two parties, one of which will be under the direction of Prof. Joseph Russell, of Washington, and the other under Prof. Todd, of Amherst. The former is an expert in solar photography, and will have charge of the corps detailed to obtain photographs of the eclipse. Permission has been obtained from the Portuguese government for the expedition to land at St. Paul de Loanda, the capital of the Portuguese possessions on the west coast of Africa. The expedition will proceed from that place inland to Maxima, on the Cuanza River, where the two parties will separate and take up stations near that point, and have all of their instruments set up before the date of the eclipse. The line of the center of totality will strike the coast at a point about 100 miles south of St. Paul de Loanda, and pass directly over the stations. The expedition will not be absent probably more than three months."

New Lumbering Enterprise.

It is said that the paid-up capital of the company which is being organized in this city to tow log rafts from Puget Sound down the coast has been fixed at $3 0,000, the greater portion of which has already been subscribed or spoken for.

The intention of the company is to erect an immense sawmill at some convenient point on the shore of the bay, the works to have a capacity for sawing out about 150,000 feet of lumber daily. The logs will be towed down by tugs from the Puget Sound forests in the shape of immense rafts, containing from 8,000,000 to 12,000,000 feet or more, whereby the cost of transportation will be reduced to a minimum.

It is claimed that there will be a saving in freight of from three to five dollars a thousand. The loss of a single raft, however, would raise the cost by a large figure. If the project can be carried out, it will mean the transfer of a large part of the lumber manufacturing from Puget Sound to San Francisco Bay.—*Pacific Lumberman.*

PHOTOGRAPHIC NOTES.

How to Give Paper a Porcelain Surface.—Sometimes it is desirable to give paper a hard finish, in order to prevent the image from sinking below the surface, and thus preserve the fine details of a picture. The following process, said to be practical by the *Br. Jour. of Photo.* and invented by Mr. Brinckerhoff, of New York, is to take a sheet of any good quality of plain Saxe, Rive, or other photographic paper coated with a warm solution of gelatine holding in suspension sulphate of barytes or finely powdered kaolin. Upon raising the paper from this emulsion it is suspended in the air until dry, when it is immersed in a solution of alum, tannin, or any other substance by which gelatine is rendered insoluble. The body of the paper is thus imbued with the gelatine and its surface has a fine texture, the pores being all filled up.

When the paper is to be used, it is salted by floating it upon a bath of chloride of ammonium and water, about four grains to the ounce of water. In this state it will keep well for many months. It is sensitized by being floated upon a bath of ammonio-nitrate of silver. An ounce of the nitrate is dissolved in sixteen ounces of water, and strong ammonia added drop by drop, with constant stirring, until the dark precipitate at first thrown down is just redissolved. Although the way here described is that by which the singularly fine specimens alluded to were prepared, yet results indistinguishable from these may be produced by sensitizing on a plain nitrate of silver solution, provided that after the paper is dry it is well fumed over ammonia, by which a great degree of richness is imparted to the tone.

After removal from the printing frame the proofs are washed first in plain water and afterward in water containing a little chloride of sodium, say a grain to the ounce. Then follow toning and fixing, the prints acquiring a fine purple in the gold bath. On removal from the hyposulphite of soda it is recommended to wash the prints in three changes of warm water, followed by a prolonged immersion in cold water.

Developing by White Light.—Mr. Charles Spiro, of this city, recently demonstrated before the Society of Amateur Photographers a successful way of developing sensitive plates without a dark room. He puts into three ounces of an ordinary single solution hydroquinone developer half an ounce of a patented inorganic dye, which imparts, in mixing with the developer, a ruby color to it. The developer thus colored is poured into a glass tray held in a small stand having a hinged cover and underneath a hinged swinging mirror. The plate, after exposure in the camera in a special double slide single plate holder, is dropped in darkness, when the plate holder is set over the glass tray, into the developer. Once in and wetted by the developer, it is safe. The holder is removed, and we see the plate perfectly plain through the ruby solution, and watch the progress of development with great ease. We have developed very satisfactory negatives in this prepared developer 6 feet from a window, 5 feet wide by 8 feet high, on which the sun was shining, with no danger of fogging. The plate has to be slightly raised from the bottom of the tray by a small stick to prevent the staining of the fingers. But the solution easily washes off. When removed from the developer it looks red, which disappears as soon as the plate is washed under the tap.

There are many uses to which the improvement can be put. In testing exposures it will be valuable, since one will be able to develop in the shade of a tree or in any house a test plate to ascertain the strength of light and correct time of exposure.

In traveling, it is of particular use at hotels, where it is sometimes necessary to wait till night before a test plate can be developed. With this little adjunct it becomes a very easy matter, and, what is of great advantage, it enables one's friends to stand around a table and watch the development.

Dark Room Windows.—In the *Photographic Review* it is suggested that the window or the glass around a lantern be made of two sheets of ruby glass and one sheet of yellow glass. We have succeeded very well by using an orange colored glass, having interposed behind it, or in front, an orange-red curtain, something like post office paper.

Photographing on Linen or Other Fabric.—For decorating table napkins, bed room trimmings, etc., the following simple process works satisfactorily, and photographers may often do much extra business by introducing it to their customers.

Boil the fabric in water containing a little soda, so as to remove the dressing, iron smooth, and saturate with—

Ammonium chloride	2 grammes (about 31 grains).
Water	250 cubic cents. (about 9 ounces).
White of two eggs.	

The above are well beaten together, allowed to subside, and strained. When dry, sensitize on the usual silver bath—rather a strong bath is to be preferred—expose, tone, and fix as for an ordinary print on albumen paper.—*Photo. Review.*

THE SEYCHELLES ISLANDS.

NICOLAS PIKE.

(*Continued from page* 200.)

I received an invitation from Capt. Thierry, of the French corvette Surprise, to visit Reciffe and Frigate Islands, and we steamed away on a glorious morning, and words fail me to give an idea of the loveliness of the view of these isles of the sea. We passed St. Anne's and others that are embowered in cocoanut and palm groves, and came first to Reciffe, but it is only at certain times boats can land. A whaleboat was lowered with eight men from the Surprise, two midshipmen from the Forte, and myself, to try our luck. We got close to the breakers, when we were signaled from shore to go back, and reluctantly we returned to the ship, and even that was not done without trouble from the strong current. The island is leased to a man who realizes a large profit from the sale of wild birds' eggs. Immense flocks of black gulls (*Anous stolida*) hover over the place, and no other birds are seen, as they resent all intrusion on their rocks, and make a deafening noise. The smell of the guano is disagreeable quite a distance off shore. The manner of procuring fresh eggs is curious. A patch on the sand is cleared from stones and old eggs, and on the following morning it is found covered with new ones, as these birds build no nest. We could see over the island, as it is almost bare of vegetation.

We then steamed to Frigate Island, which lies about 50 miles from Mahe. Schools of porpoises played round the vessel. They are smaller than the ordinary porpoise, of an olive brown, with a white stripe from head to tail, and leaped out of the water many feet in an oblique direction. They are called "cow fish" by whalemen. When about three miles from the island, we found a strong current, and one single rock just shows above the waters, which break madly round it. At a short distance from it the soundings are over 50 fathoms, so that it is probably (as I believe some of the islands are) the top of some submerged mountain of a former continent.

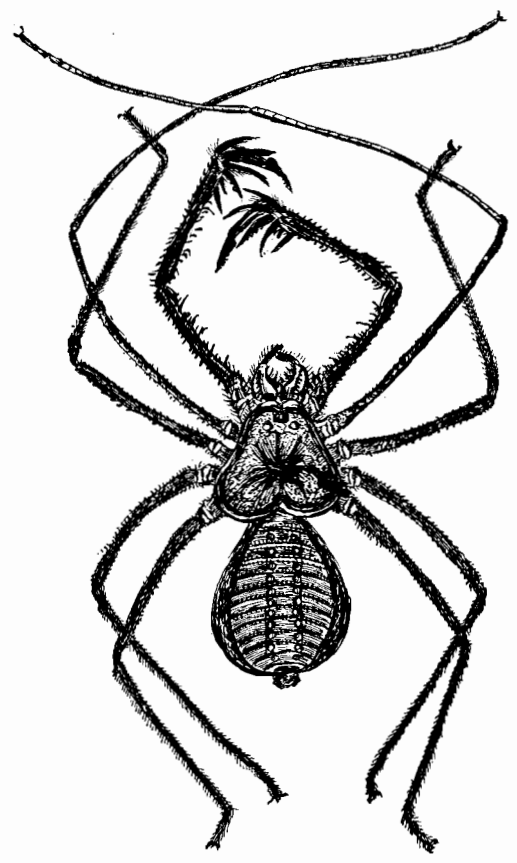
Very soon after we had fired a gun, we saw a large boat approaching, which contained the proprietor of the place, M. Savy, who invited us to his house, and we landed on a bold shore. Our entrance was only effected by anchoring the boat in the surf about 50 feet from the shore, when two men paid out the cable till her stern was near enough to the rock for us to leap out. We had to climb up the steep mountain side for about 300 feet, passed over the top through a few stunted trees, and descended the other side to M. Savy's house in the lowlands, shaded by magnificent banyan trees, forming long alleys of shade, impervious to the hottest sun. After doing the honors of his house most hospitably, he proceeded to show us his small but interesting domain.

He has a distillery for rum made from the sugar canes, a fine vegetable garden, and Madagascar cattle were grazing round the place. He employed about 40 men to express the oil from cocoanuts, of which he had a large plantation. The appliances for the purpose were very rough and primitive, and by the clumsy apparatus used, half the oil was lost; £10,000 worth a year of this oil has been exported from this and other islands, but double the quantity might be produced, if proper machines were had. After seeing a good deal of the place, I began hunting about the bushes, but was warned to beware of the scorpions, and especially of a large species of spider, genus *Phrynus*. Frequently the bite of one of these creatures, when not promptly attended to, will cause death or long illness. Even when well dressed with ammonia, it will lay the victim up for a long time. The poison induces vomitings, cramps, and swellings of the whole body. The Mozambique workmen are so afraid of it, that when I came across one they ran away for dear life, and no inducement could make them help me put it in the bottle of alcohol. I was fortunate enough to secure a number, though they are formidably armed with spines and claws. They belong to the "whip scorpions" (see cut) and spiders of this genus are only known from the Seychelles, Brazils, and Lower California. I captured a few scorpions eight to nine inches long, but the men were not half as afraid of them as they are of the spiders. A large *gecko* is also found here, peculiar to this island and Isle Curieuse.

I here saw the very rare and beautiful bird the *Pie chauteuse* (*Copsychus seychellarum*), not long discovered by Mr. Edward Newton and his brother, and I should have liked to procure a specimen, but M. Savy was unwilling to have one shot, as this and other fine indigenous birds will soon be but memories of the past like the dodo. Cats and rats are in such formidable numbers, that the birds and other things are being rapidly destroyed. Frigate Island has but little natural vegetation, few large trees, and only here and there clumps of bushes, and is entirely of granite. We got a thorough wetting going back to the corvette, and M. Savy accompanied us, as he knew the entrance to the reefs.

On the 3d of September we were off at daylight up the mountains to the northwest of Victoria. As we passed along the base we wended our way with difficulty between enormous blue granite bowlders, the largest I ever saw in any part of the world. Some of them were thousands of tons in weight, luckily sufficiently apart for us to creep through them. In many places giant palms overshadowed them, showing how long they must have lain there since the time they were dislodged and toppled over from their mountain bed. In some places the people had taken advantage of the square sides of the bowlders, making them serve as one end for their houses, and, *certes*, they were safe on that side from hurricanes or thieves! I have seen stone broken in many countries, but here I found a novel method. I came upon a large fire of cocoa fibers, and asked for what such an amount of good fuel was being wasted. I was told, to crack the granite rocks that are so hard the ordinary drills will not pierce the great bowlders, so recourse is had to heat to split them.

At intervals we met with great bread fruit and jack trees laden with fruit, and every eye was alert to spy out the rare vegetable treasures everywhere. Once I came to a stand. I was so attracted by a tree in the distance that I shouted to my comrades, who came running up. It was indeed a *rara avis*—a great double-headed palm of the genus *Hyphœna*, species unknown, about 50 feet high, as straight as an arrow, with a rough, spiny bark, of equal size from the collum up. The leaves, dark and long, formed two crowns divided at top and hanging gracefully all round; but it was too high for us to procure the fruit. We rested at the summit of the mountain for lunch, but had numerous uninvited guests, for the lizards were so tame that they ran over us, and I requited their friendship by bottling some, as I caught them easily by hand. One of the most curious things to a stranger is the mason wasp that intrudes everywhere. On descending, we came upon a bowlder 15 by 30 feet and 17 feet high. It had fallen over three large round stones, and formed a sort of cave. Attracted by ferns and lichens at the entrance, I crawled in under the bowlder and found the whole roof covered with nests of the mason wasp. As long as I confined myself to being a spectator they left me alone; but when I tried to detach a nest with a stick I had to beat a hasty retreat, for, like bees, they combined for mutual defense. We came to a grove of fine cacao trees (*Theobroma cacao*); but, although clusters of fruit hung on every tree, the rats had extracted all the kernels. A few clove trees also flourished, the spicy fruit scattered over the ground, and these were nearly all left of the trees imported by the French, and they were utterly neglected.



PHRYNUS SP.—POISONOUS SPIDER. (NATURAL SIZE.)

September 7, I accompanied the admiral to Praslin and others of the group. When we arrived, we had to steam round Praslin to a beautiful bay formed between it and Isle Curieuse. The peculiar rocks resembled old Druidical ruins, such as I had seen in England. We landed at Curieuse and were received by Dr. Forbes, an old Scotchman, who has been over forty years there and has charge of the leper establishment, which we visited. Small comfortable huts are erected near the sea, under the shade of palm and cocoa trees, and all were neat and clean. The greatest praise is due to the doctor, who has devoted so many years to caring for these poor outcasts. With his kind treatment and the liberality of the government all is done to alleviate the terrible sufferings that can only end in death. Even with all this there is something so loathsome in the disease I was glad to return on board.

Next morning we landed at Praslin and were received with boundless hospitality by another Scotchman. This is the last stronghold of the famous coco-de-mer, there being very few in the other islands. On these trees are found two kinds of shells, one a very large *Helix* and a *Cyclostoma*, and never anywhere else. Grand ferns, with long waving fronds 9 to 10 feet long, waved among the granite rocks, and rare and very scarce birds were seen, and a curious large green lizard was everywhere. There is a good Episcopal church and school here. We also visited La Digue, but encountered heavy surf close inshore. Large quantities of oil are exported hence, and one man showed us a plantation of 60,000 cocoanut trees, all in full bearing, and groves of young ones coming on. A few rare birds, snakes, and a turtle peculiar to La Digue are all that are found here. On our return to Mahe we had to part from our kind friends on board the Forte, as the admiral had decided to leave at once for Grincomalee, and it was with mutual regret. I am sorry to add that this brave officer and thorough gentleman died soon after his arrival there, universally lamented.

One more mountain climb, and to say farewell to these lovely islands. We had still to ascend the Morne Blanc, the highest land in the whole group, and prepared to spend two or three days on it, taking three Mozambiques to carry our *impedimenta*. It was a long and sharp ascent to a plateau about half way up, where we arrived hot and tired. However, fatigue was soon forgotten, when we sat down to arrange the treasures collected, for we had snatched at everything available. Ferns, orchids, shells, reptiles, our *vasculums* were already overflowing. We rested that night to rally for the climb to the top. There the vegetation was sparse, but the view was magnificent, as the whole of the islands lay mapped out at our feet, in a sea calm as an inland lake and blue as sapphire, save where it combed round reefs and looked like frosted snow and ice. Our men, in spite of their loads, had climbed like monkeys, and here they reveled in the wild mandarin oranges, guavas, and other fruit, all grateful in the heat. There was a curious absence of bird life. The descent was worse than the ascent, for we had to cut our way through the rank vegetation of what is called the Black Forest. Every step had interest for us, but was not devoid of danger. In many places tons of granite had been dislodged from the peaks above, and it was not pleasant to look up at the crags and think that at any moment one of these erratic rocks might follow us. We spent two more days before returning to Victoria, and I took occasion to visit the reefs on the opposite side to Mahe, as it was my last hunt in this most interesting part of the world. I left on the 24th of September, by the mail steamer, with such pleasurable reminiscences as will last a lifetime, and treasures of all kinds.

Pains in the Head during the Growing Period.

It is a matter of common occurrence that young people of both sexes are compelled to interrupt their attendance at school on account of a cephalopathy that the author terms *cephalalgia of the growing period*. It commonly occurs between the ages of twelve and eighteen years, is accompanied by dizziness and *malaise* and is excited by any intellectual effort, sometimes even by the reading of an entertaining book. Its location is mainly in the temples, but it also involves the hairy scalp from the orbits to the mastoid processes, or even the entire head. The patient is at times irritable, easily excited, or inclined to sadness and to spells of weeping. They are wont to complain that they cannot do as their comrades do. It is a mistaken idea to treat such persons as malingerers, and to attempt compulsory means, which cannot possibly yield good results. Together with the phenomena mentioned are also to be seen anomalies of refraction and accommodation, as myopia, hypermetropia, and astigmatism, and, in fact, diseases of the eyes in general. Proper glasses or other appropriate treatment will often lead to a rapid recovery, but such is not always the case. Additional means of treatment should be complete cessation from intellectual effort, change of air, and appropriate medication.—*Rev. mens. des Mal. de l'E.; Arch. of Ped.*

Barnacles.

The Ranger, U. S. N., had attached to her bottom as much as twelve tons of marine growth at her last docking in the Brooklyn navy yard, and this, too, after she had been for some time in the fresh waters of the Sacramento, in which a portion of the growth had perished. The Atlanta originally had a coating of anti-corrosive paint next to her plating, and an outside coat supposed to be proof against the attack of barnacles. On an examination of her hull, a few days since, it was found, however, that barnacles had eaten their way through the anti-corrosive paint, and had firmly attached themselves to the ship's bottom. The frequent dockings of the Atlanta and the Boston have demonstrated the costliness of keeping steel bottoms in anything like a fit condition for satisfactory speed performances, and there is an idea of sheathing them with an alloy of copper.

RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM ACTUATED VALVE.—William L. G. Williams, Jermyn, Pa. Combined with a main valve mounted to turn and provided with an arm is an auxiliary piston operated by live steam from the cylinder and provided with a pin engaging the valve arm, with other novel features, dispensing with all outside mechanisms for operating the valve, which is automatic in its operation.

BOILER. — Isaac Hulme, Yaquina, Oregon. This is a boiler in which petroleum, coal, coal oil, etc., may be used to get up steam, and has an outer shell of a boiler and an inner shell forming a burning chamber, into which extends a water arch, a burner injecting a mixture of air and oil against the water arch in the burning chamber, flues leading from the latter to the smoke arch, and an outwardly opening valve in the smoke arch to discharge the gases into the water chamber of the outer shell.

METALLURGICAL FURNACE.—C. Peifer, Allegheny, Pa. This is a straight-draught furnace having a heating chamber terminating in a neck, over which is a stack, air spaces in the side walls of the neck extending above and below its floor line, there being below the floor line a series of cold air inlet ports, protecting the walls of the heating chamber at the neck from being cut away by the boiling slag.

IGNITOR FOR GAS ENGINES.—Isaac F. Allman, Jersey City, N. J. By this invention, a barrel connected with the interior of the gas engine cylinder is provided with slots for the passage of the igniting flame, and a plunger is held to slide in a barrel, a fixed apertured plug dividing the interior of the plunger into two compartments, one continually connected with the interior of the cylinder, and the other alternately connected with the igniting flame and the interior of the cylinder.

Railway Appliances.

CAR COUPLING.—John W. Roberts, Watford, Ontario, Canada. This coupler has a tubular drawhead, comprising a head with an opening in its bottom and a body extending rearward beneath the car, provided with a longitudinal slot and guideways upon which a link is adapted to travel, the coupler permitting uncoupling from the sides without the necessity of the operator passing between the cars.

CAR COUPLING.—John A. Dean, North Ogden, Utah Ter. In this coupling a link is employed having a continuous bore and with recessed headed ends, to be received by sockets carrying jaws arranged to enter the link head recesses, the invention dispensing with the ordinary tubes employed in the operation of steam or air brakes by making a passage through the coupling link, and the parts being so arranged that the cars may be uncoupled by throwing a lever.

Agricultural.

TRANSPLANTER. — Jacob K. Nissley, Jacob S. Mumma, and Jacob Hostetter, Florin, Pa., and Joshua W. Harris, Staunton, Va. Combined with the casing and the feed tube are hinged shovels and hinged coverers, with connecting rods having crank arms and a single operating lever, the invention being an improvement on a formerly patented transplanter, and being simple in construction and effective in operation.

SEED PLANTER AND FERTILIZER DISTRIBUTER.—Jessie A. Childs and William E. Muir, Coushatta, La. Combined with the framing of this machine are a hopper, adjustable drill boards for drilling one or two rows, and a coverer running in rear of the drill boards and having its teeth or blades adjustable, whereby to cover one or two rows, for use with fertilizer, seed, or fertilizer and seed mixed.

HAY FORK.—Joseph S. Gochnauer, East Berlin, Pa. This fork has a skeleton frame with vertical side bars and a tine pivoted to the lower end of each, a yoke or bow being pivoted within the frame and connecting rods pivoted to the bow, with other novel features, the invention being an improvement on a former patented invention of the same inventor whereby the fork may be more conveniently and positively manipulated.

Miscellaneous.

WATCH CASE PICTURE HOLDER. — Gaspard Schelker, Brooklyn, N. Y. Combined with one of the outer covers or lids of the watch, having a circular offset, is a bezel sprung on the offset, and a revoluble apertured disk resting over the outer face of the cover under the bezel, whereby pictures may be held on the covers, to be covered or uncovered at will.

LEAF TURNER. — Cyril P. Brown, Spring Lake, Mich. This device has a series of arms, each with a loop at one end and a folding leaf-holding fork at the opposite end, with a support for the loops, and a key pivoted to the center of the instrument and carrying a double-acting catch adapted to engage the arms upon either side of the instrument, for turning the leaves of music quickly, etc.

CHECKING AND RECORDING DEVICE. —Frederick Sultzer, Yonkers, N. Y. This is a device for the automatic registering of the time when workmen or employes enter upon their duties, a frame being adjustably mounted in a case to receive a spaced and divided chart, the front of the case apertured to correspond with the chart divisions, and record attachments being arranged in connection with the case and chart.

LIVE STOCK MARKER. — Andrew Casper, Argo, and Andrew Jacobson, Omaha, Neb. This marker has handles pivoted together to form jaws at their opposite ends, the outer end of one member being formed with a rectangular frame in which are held interchangeable die blocks, with stencil cutting dies of numbers or figures, for branding or marking upon the ears of cattle, etc., there being also pivoted to the frame another lever for bringing additional force on the jaws when desired.

HORSE DETACHER. — Henry J. Kennedy, Bristol, Pa. This invention provides an attachment for single and double trees whereby the traces may be disconnected from their supports, and the horses thus freed from engagement with the vehicle, the invention covering a novel construction and combination of parts.

BACK BAND HOOK.—Francis A. Yost, Paducah, Ky. This is a hook of the kind employed in connection with chain traces, and consists of a plate having an outwardly and upwardly curved and bifurcated arm forming trace-supporting loops, the arm having its upper end secured to the upper part of the plate, and provided with a tongue.

TERRET.—John T. Stoll, Sacramento, Cal. This terret is formed with an opening, whereby the strap or line may be inserted edgewise through the opening, the terret being made in the usual form in general outline and slotted, the adjacent ends of the members of the ring being in line with each other.

WAGON TONGUE SUPPORT. — Robert Lynn, Sr., Brighton, Iowa. This invention covers a novel application of a spring and socket plates to hold up the tongue and relieve the horses of its weight, the device being simple and cheap, and one which can be readily applied by a farmer or other user to an ordinary wagon, without the aid of a skilled workman.

BABY CARRIAGE.—Rodolph McMakin, New Albany, Ind. By this invention the front axle is pivotally connected with the carriage body, and a propelling and guiding bar extends rearward from the front axle, and is provided with a handle for pushing and directing the carriage, which can be done without using the handle as a lever to pry or twist the carriage to either side.

DISH DRIER.—Alice J. Wilson, Abilene, Texas. This is a novel form of covered vessel, with a false bottom and perforated top, in which the dishes are to be placed after washing, and hot water poured over them, the steam passing off through the perforations of the cover, and the dishes being dried by their own heat without wiping.

GAS STOVE. — James Gibbons, Jersey City, N. J. This is a stove with an inner base and burner and a fire pot with surrounding drums for superheating air passing to the burner and for the escape of hot air to the room, being designed for the combustion of fluid fuel, such as coal or water gases, and to effect the work so perfectly as not to vitiate the air of a room in which the stove may be placed.

CLOTHES LINE HOLDER.—Henry A. Denman, Brooklyn, N. Y. This is a holder for use in windows, and has two bars adapted to slide upon each other and carrying a hook adapted to receive the clothes line pulley, a clamp for locking the bars when extended and spurs to prevent the displacement of the bars when adjusted in a window.

HAMMOCK AND SEAT SUPPORT.—Joseph J. Johnson, Dayton, O. This is a support which can be readily moved from place to place, and consists of a supporting wire or cable, a frame carrying wheels which ride upon the cable, the frame having hammock-supporting hooks and a seat, with means for driving one of the wheels.

EARTH CLOSET COMMODE. — John W. Stowell, Putney, Vt. This invention relates to an article of household furniture combining a commode and an earth closet in a manner designed not to indicate the presence of the closet when the structure is folded or closed.

CONSTRUCTION OF ARCHES. — James Bogert, Yonkers, N. Y. Combined with uprights, and girders uniting them, are diagonal brace plates secured to the uprights and girders, and anchors secured to the brace plates, girders, and uprights, with other novel features, whereby memorial arches, etc., may be built in a simple, expeditious, durable, and economical manner, in an open space, and stand firmly without the aid of abutments or tie rods.

RUNNING GEAR FOR VEHICLES. — Charles A. Blume and Francis N. Armstrong, Colfax, Ind. This invention relates to vehicles having their wheels mounted on pivoted axle arms arranged to be operated by the pole or shafts in turning, the gear being in all its parts a combination of T steel, angle steel, bar steel, gas pipe, and malleable iron, and running easily, permitting the vehicle to turn in a very small space.

DERRICK. — William E. Chapman, Brooklyn, N. Y. This invention provides a derrick applicable for use in the raising of extremely heavy weights, it being so constructed that, in use upon a float, the weight is brought beneath the apex of the supporting frame and above the center line or keel, maintaining the equilibrium of the derrick, this derrick having been employed to raise sunken vessels bodily.

BRICK MACHINE.—Gustavus Van Deventer, Matawan, N. J. In this machine the under or bottom side of the plunger is formed with its outer edge depressed or at a lower level than the opposite edge next the mixer, to exert a great pressure at the outside edge of the mould, where the clay is liable to scant, than at the side next the mixer, where the clay is more or less compressed and fills the full capacity of the aperture to the press box.

BRICK MOULD SANDING MACHINE — George E. Smith, Kingston, N. Y. Combined with a supporting frame is a rotary sand box, a disk provided with pins being mounted on the shaft of the box, and a lever pivoted to one side of the frame connected with a forked lever engaging the pins of the disk, with other novel features, whereby the moulds may be regularly fed forward to the press and will at the same time be effectively sanded.

BARREL HOOPING MACHINE. — Frank Glankler and William W. Simmons, Memphis, Tenn. This invention provides a machine for trussing or squeezing together the ends of a barrel, and in the same operation forcing upon the barrel the end hoop with the same advance motion which trusses the barrel.

GRINDSTONE TOOL HOLDER. — Alexander H. Dick, Cramer's Hill, N. J. This is a device in which a bed plate is made to support the handle end of the tool, a weighted arm being pivoted on the bed plate and provided with a clamp engaging the tool blade, the device being simple in construction and designed to automatically hold the tool in any desired position on the grindstone.

LANTERN. — Ole Handeland, Fort Sisseton, Dakota Ter. This is a lantern specially designed to be fastened on a horse's back, its holder comprising a casing having a transparent slide in its front and a flange on its bottom, and a saddle with a platform having a marginal guideway to receive the flange of the bottom of the casing, the arrangement being such that the wind cannot extinguish the light.

TURFING IMPLEMENT. — Melville C. Ayer, Biddeford, Me. This invention covers an improved feeding device for turfing or rug machines, serving for automatically feeding the machine forward, and being very simple and durable in construction and very effective in operation.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1340) T. S. W. writes for a practical rule for finding the length of a chord between the centers of two holes to be laid off on a circle of any diameter. For instance, I want to lay off eight holes on a circle ten inches in diameter. What will be the length of the chord between two consecutive holes? I want a rule that I can use without a protractor? A. No general rule can be given. By the square you can divide a circle into four parts; by using the radius as a chord, you can divide it into six parts. Other divisions can be made by the use of the dividers, starting with the full circle or using the division into four or six parts as a basis.

(1341) E. J. F. asks: How to make an ink that will copy without the use of press, brush, or water. A. Dissolve an aniline color in water, and add a little glycerine. It is well to dissolve the color in alcohol first. About 10 per cent of glycerine should be sufficient.

(1342) J. F. D. asks for a cheap white enamel or flexible veneering, to coat pasteboard, to strengthen and to thicken it. A. Paper is enameled by coating with a mixture of 100 parts kaolin (perfectly dry) and 24 parts paraffin melted and mixed hot. After cooling it is reduced to powder and worked into paste in a paint mill with water, and then applied to the paper. Or try a mixture of dammar varnish and Chinese white. The last will strengthen the paper a little; the first will not.

(1343) J. M. M. asks for the method of cleaning and polishing clam shells. A. Clean with a rag dipped in hydrochloric acid, wash in warm water, dry in sawdust, and polish with chamois leather. If the shell is too dull, varnish, or else rub with a little tripoli powder and turpentine on wash leather; then with fine tripoli alone, and with olive oil, finally rubbing up with a chamois. Boiling in lye is sometimes resorted to, and the shells polished on wheels.

(1344) E. B. B. writes: 1. Can you refer me to a work that treats thoroughly on valve setting? A. We can supply you Rose's Slide Valve for $1 by mail. 2. Also inform me the process it is necessary to go through to find the weight of a cubic foot of air. A. At standard temperature and pressure one cubic foot of air weighs 536·96 grains, or 1-816 of the weight of the same volume of water. It has been determined

by weighing a vessel of known volume, first exhausted and then full of air the difference of weights representing the weight of air contained.

(1345) J. P. asks for (1) the receipt for making red fire. A. Mix 9 parts nitrate of strontium; 3 parts powdered sheilac, and 1½ parts chlorate of potash. 2. Also for making quick match composition. A. Quick match composition is made of 4 parts saltpeter, 2 of gunpowder, 2 of charcoal, and 1 of sulphur.

(1346) R. R. C. asks if commutator for 8 light dynamo as described in SUPPLEMENT, No. 600, could not be made by having 24 strips of sheet copper and 24 strips of glass affixed to a small cylinder of wood by shellac on under side, and wound with varnished string on ends of cylinder to hold strips in place, and to have small screws in end of copper strips to connect with armature wire, strips of copper and glass to be one thirty-second or one-eighth inch thick, whichever would be the best; the small spaces between glass and copper to be filled with shellac to prevent dust from filling in. A. Your form of commutator is objectionable on account of the wide spaces between the copper bars, also on account of the shellac filling. Better place bars one thirty-second inch apart and either have air spaces or fill the spaces with strips of mica. Probably your winding of cord and the varnish would hold the copper bars. You might make slits in the wood with a thin saw for the mica.

(1347) R. R. N. writes: Would you name a fluid that is not very heavy, and is a good conductor for electricity? A. No such fluid is known. A solution of sulphuric acid of specific gravity 1·215 has one of the lowest resistances of aqueous fluids, but it is 500,000 times greater than that of silver.

(1348) G. W. W. S. asks: 1. About how many one gallon cells of gravity battery would be required to run an Edison six candle power incandescent lamp, which requires 1·40 amperes of current, I am well aware of the fact that this style of battery is not suitable for this purpose, but I thought that if I would connect enough cells together, I could produce current enough to run a lamp of the size named above. If I could succeed in running the lamp with gravity battery, about how long would it last without having to be replenished? (I mean the battery.) Which would be the best way for me to connect the cells, in parallel or in series? Also please inform me how to connect in parallel. A. Owing to the internal resistance of the gravity battery and its comparatively small E. M. F., it would require about 180 cells to run your lamp. These should be connected 15 in series with 12 series in parallel. It would run for several months. 2. If this battery cannot be used, how many cells of the new compound Fuller battery would be required, and about what length of time would it run the lamp without being recharged? A. It would require about 40 cells of Fuller battery connected 8 in series with 5 series in parallel. It would probably run for a week.

(1349) C. C.—See answer to G. W. W. S. on this page in regard to primary batteries for electric lighting. The secondary battery referred to can be charged by means of a primary battery, but it is a tedious process which does not pay.

(1350) W. O. G. writes: 1. I see frequently in the papers that in the oil regions closed naphtha tanks are exploded by being struck by electricity. I had supposed that to explode naphtha it was necessary to have it exposed to the atmosphere. Please tell me if I am right. A. The tanks are struck by lightning and ruptured and the naphtha ignited, or it may be that some leakage is set on fire by lightning. The naphtha in a tightly closed tank will not be affected. 2. Will you also give the chemical formula of naphtha distilled from petroleum oil? A. It varies widely, consisting for the most part of paraffines [of the series $C_nH_{(2n+2)}$] and olefines (of the series C_nH_{2n}).

(1351) J. C. asks: 1. What kerosene oil is composed of? A. It is composed principally of hydrocarbons of different series (see preceding query). 2. What is the cause of that blue light around the base of the light? And what is the cause of the same reason in the candle? A. The blue light is due to combustion at a comparatively low temperature, probably of carbonic oxide gas. A. How to melt coal? A. Bituminous coal undergoes a partial fusion when heated in a closed vessel. 4. How to make sodium. A. For manufacture of sodium we refer you to any chemistry.

(1352) D. S. H. asks for a recipe for making wine or cordial from common rhubarb (large variety). Rinse gently 40 pounds of best quality rhubarb stalks in a 15 or 20 gallon tub. Add 4 gallons of water, stir and squeeze the pulp with the hands so as to separate the juice. Let it rest for a few hours, strain, and press through a coarse cloth. The residue may have one gallon more of water pressed through it. Add 30 pounds loaf sugar and after its solution water to make it up to 10½ gallons. Put it in a tub covered with a blanket and some boards at 55° to 60° Fah. until it begins to ferment. Then put into a cask a portion at a time, as its working decreases until all is in. Let the scum as it works run out of the bung hole. When nearly through fermenting drive the bung, put in a spile, which is to be removed every few days until the barrel is safe from bursting. Use more or less sugar according to the strength and sweetness desired.

(1353) N. G.—There is nothing better than good clear pine or cedar for a model yacht. Block it out roughly inside and outside. Keep it out of the sun and it will not crack. When finished oil thoroughly inside and outside with raw linseed oil and let it dry for a number of days (not in the sun). See a book "Hints to Beginners in Amateur Yacht Designing," by Biddle, which we mail for $1, or "Model Yachts and Boats" by Grosvenor, a larger book, 121 designs and working diagrams, $2 mailed.

(1354) W. V. S. writes: I wish to construct a solenoid to exert a pull of 5 pounds in its core with a 100 volt current. What size and length of wire should I use and what current would it require? A. Your potential is exceedingly high. The solenoid which would be manageable at such a potential would have very high power. Make a solenoid of No. 20 wire, using about 100 feet, and introduce it in shunt with a resistance in the other branch of one-tenth ohm. This you can get from a piece of lamp carbon, uncoated, ½ inch diameter and 12 inches long. Your best plan is to put in a longer piece of carbon with a sliding contact, connect your coil, and slide the contact along until proper power is attained. If you have to pay for all the current, this method is, of course, very uneconomical.

(1355) On. & Co. ask: What material is good for a lining of a wooden lye tank so that the strong lye cannot leak through the wood joints, as the lye does so through the most watertight joints of wood materials? A. Use following composition on all leaking points: Burgundy pitch 150 parts, gutta percha in shreds 25 parts, powdered pumice stone 75 parts. Melt together first the gutta percha and pumice stone and when well mixed add the Burgundy pitch. Use a hot soldering iron or poker to melt it in with. The drier the tank, the better will be the result. It is well to try it on a small scale, and if satisfactory to coat the entire tank with it.

(1356) M. A. C. writes for the process of crystallizing tin for covering trunks. A. Hold the plate slightly heated over a tub of water and rub its surface with a clear solution of 4 parts nitric acid, 2 distilled water, and 1 salt or sal ammoniac. When the figure is well developed dip and wash it off carefully, so as not to disturb the figure, dry at low heat, and lacquer. Or just as a plate is leaving the tin bath in the regular tinning process, if cold air is blown upon it as the tin solidifies, a similar result will be attained. Tin plate for covering trunks is frequently given relief designs by passing it between engraved rollers.

(1357) T. J. asks: 1. Are there any metals which when used as contact points, dipping in mercury, will not be injured by amalgamating? A. Use platinum or steel. 2. In case of alloy would the mercury be injured for use in an air pump? A. Yes; it will be injured for such use. 3. Will the passage of electric current or heat generated when contact is broken prevent or correct alloy? A. It will not.

(1358) J. B. writes: What can I use in the shape of an iron perforated pipe to assist combustion in a fire box? Would common iron pipe burn up if a current of air at 110° was kept passing through it over a hot fire? If so, tell me what I can substitute for iron pipe. A. Extra strong wrought iron pipe will last several months, as an air pipe in a furnace, if it can be kept below red heat. Heavy cast iron rectangular pipe partially built into the brick work is also used for hot air jets for perfecting combustion. Hollow fire brick tile has also been tried. We cannot give reliable advice without knowing exactly what you wish to accomplish. There has been much experimenting for perfecting combustion in boiler and other furnaces, with but indifferent results.

(1359) J. R. T.—There is no way of indicating water veins or anything else beneath the earth with a forked stick. You cannot prevent the taste of clay in water that lies upon a clay stratum. A pipe drain through the clay may strike a water vein below of purer quality.

(1360) J. W. writes (1) for a receipt to enamel wood (black). A. The best plan is to have it japanned. Varnish may be mixed with the paint or several coats may be applied, and each in turn rubbed down with pumice and water, and after varnishing several times with similar rubbings down the last coat may be polished with rotten stone and oil. 2. Can porcelain be dissolved into a thin liquid by acids? A. No.

(1361) E. H. N., M.D., asks if repeated boiling of surgical cutting instruments (in water) will affect their temper. A. No. The temperature of boiling water is too far below that at which the instruments were tempered for any effect by boiling upon their cutting qualities.

(1362) W. M. A. asks: Do you consider the valve motion commonly used on locomotives a direct valve motion? A. Yes; a direct valve motion. The shifting or stationary link does not change the direct action of the eccentric. The old rock shaft valve gear was an indirect valve motion.

(1363) G. W. H. asks: For forcing draught in furnace on steamboat, is a blower run by separate engine more economical than steam jet in smoke stack? If it is, please state reasons. A. This is not yet a settled point in steam making. With a small boiler the jet, if of best form, is probably the most economical. There is more economy in making the boiler large enough to give sufficient steam without jet or blower.

(1364) J. H. L.—We do not recommend any attempt to repolish a theodolite, except it be in the hands of an instrument maker. Carefully and thoroughly clean off dirt from the surface. The instrument has a coat of lacquer that protects the surface, and if removed this has to be renewed, which requires experience in instrument work. Generally the best polish for brass is rotten stone and oil.

(1365) G. G. M.—The great telescope of Lord Rosse has a speculum 6 feet diameter, 55 feet focus. It is still in use.

(1366) E. S. asks: How is chipped glass made? It has a feather or frost like appearance. A. It is made in several ways. The following is one method: The body of the vessel is coated with another kind of glass and while hot is cracked by application of water. Then it is partly remelted.

(1367) E. H. B. asks: Will you kindly answer through your paper, how to thin mucilage? I use a sponge top bottle, and the mucilage is so thick it does not come through easily. A. Thin mucilage with water. To clear the sponge, place some water in a saucer and press the sponge down repeatedly in it.

(1368) W. A. T. asks how to color the brown streaks black on buffalo horns, after they have been polished? A. Apply a dilute solution of nitrate of silver with a brush or rag several times, until the desired intensity is obtained. Allow it after each application to dry in the sun perfectly before applying the next coat. Polish when sufficiently black.

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